







FIRE PROTECTION

Office of Safety, Health, and Environmental Compliance (10NA8)

design manual

Sixth Edition - September 2011

Department of Veterans Affairs

Office of Construction & Facilities Management

Summary of significant changes to the 6th edition of the VA Fire Protection Design Manual

A. Clarified building construction type and building separation requirements (see Ch 2).
B. Clarified requirements for parking garages (see Ch 2).
C. Clarified door locking criteria to comply with NFPA 101 (see Ch 2).
D. Clarified requirements for data centers (wet pipe sprinkler protection continues to be required) (see Ch 3).
E. Clarified water supply requirements to coincide with latest Physical Security Design Manual (see Ch 5)
F. Clarified requirements for sprinkler systems (see Ch 6), including

- Restrictions on use of CPVC sprinkler piping
- Permission to use NFPA 13R and NFPA 13D for residential occupancies
- Sprinkler requirements for clean rooms
- Permission to use sprinklers that are not FM-approved for special cases
- Permission to use standard response sprinklers (in lieu of quick response) for special cases

G. Clarified fire alarm system wiring designations to coordinate with current edition of NFPA 72 (see Ch 7)

2. Most of the changes mentioned above were intended to clarify existing criteria. We do not anticipate that revisions to the 6th edition of the VA Fire Protection Design Manual will result in significant changes to projects in progress. Where significant issues arise as a result of revisions in the 6th edition, such issues should be directed to this office (10NA8).

3. Implementation guidance with respect to the NFPA Fire Codes is provided in section 1.3.b as follows:

> Fire Protection design shall be based on the latest editions of the NFC at the Date of Award of the contract to the Architectural/Engineering (A/E) firm (or Design/Build firm). Under special circumstances, the VA will require compliance with a more recent code edition when significant changes to the code have occurred between the Date of Award to the A/E and the Date of Award to the prime contractor for construction.
>
> *Note: Special circumstances would include a situation where a designed project sat "on the shelf" for an extended period of time, or where a significant change to the code was made and where incorporating that change would improve safety in the opinion of the AHJ.*

4. With respect to application across VA, the VA Fire Protection Design Manual is intended to apply to all VA projects (VHA, VBA, NCA, OIT, etc).

Additional modifications include making document Section 508 accessible for posting on Internet, including latest seismic map, and updating mail code symbols for CFM.

FIRE PROTECTION DESIGN MANUAL

DEPARTMENT OF VETERANS AFFAIRS

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FIRE PROTECTION DESIGN MANUAL
DEPARTMENT OF VETERANS AFFAIRS

INTRODUCTION

The primary goal of this manual is to provide an environment for occupants that is reasonably safe from fire and products of combustion. To achieve this goal, the objectives are to protect occupants who are not intimate with initial fire development for the time needed to take appropriate action, and to improve the survivability of occupants who are intimate with initial fire development.

The secondary goals of this manual are to provide a reasonable level of building usability and property protection from the effects of fire and products of combustion. To achieve these goals, the objectives are to increase the likelihood that, in the event of a fire, critical operational functions are not interrupted for longer than 24 hours and the loss of real or personal property does not exceed $500,000.00.

The criteria in this manual are based on the assumption of a single fire source.

1. GENERAL

1.1 Scope:

A. This manual contains fire protection engineering design criteria to meet the goals identified above, by protecting patients, visitors, and staff; maintaining the continuity of important clinical and administrative activities; and protecting VA property. This generally will require the installation of automatic sprinkler protection in VA owned buildings. In VA occupied buildings, sprinkler protection shall be required to protect VA property or for compliance with the Life Safety Code or the Federal Fire Safety Act PL-102-522. See Section 6.1. (Note: Protection shall not be required to limit the loss of non-VA property.)

B. This manual applies to all categories of VA construction and renovation projects, station level projects, and acquisition of all VA property (including leases).

C. This manual supersedes new construction criteria contained in VA Circulars, Information Letters, and Directives, which are dated prior to the publication date of this manual.

D. This manual is intended to apply to new construction. It can be used as guidance with respect to existing features.

1.2 Application:

A. Use this manual in conjunction with the Scope of Work paragraph in the Architect/Engineer (A/E) Package and PG-18-15, Minimum Requirements for A/E Submissions, which defines the information to be shown on drawings and work to be completed at each stage of design. In addition, coordinate with requirements from other applicable VA criteria listed in Appendices C and D.

B. The facility shall solicit the services of a third party with knowledge of applicable fire protection criteria such as the respective Network Safety Manager, Network Safety and Fire Protection Engineer (SFPE), or other qualified fire protection engineering consultant during design in order to insure the project as designed by the A/E complies with such criteria. Obtaining these third party services early in the design process is strongly recommended. The third party entity shall be involved in reviewing the design, but may also be involved with reviewing contractor’s submissions, conducting pre-occupancy life safety inspections, and/or witnessing final fire protection acceptance testing.

C. For code interpretation and enforcement, the Authority Having Jurisdiction (AHJ) for all VA projects is ultimately the Deputy Under Secretary for Health for Operations and Management (10N), with the Safety and Fire Protection Engineer (10NA8) acting as the VA Fire Marshal. At the Medical Center and Veterans Integrated Service Network (VISN) level, the respective Network Safety Manager or Network Safety and Fire Protection Engineer (SFPE) has the option to act as the AHJ representative on behalf of 10NA8 and make local AHJ decisions in areas where they are competent.

1.3 Fire Protection Codes and Standards:

A. The Public Buildings Amendment Act (PL 100-678) requires all federal agencies to follow the latest editions of nationally recognized fire and life safety codes. It also requires federal agencies to give local fire protection officials the opportunity to review and comment on projects for compliance with local regulations and compatibility with local fire fighting practices. All reviews by local fire protection officials shall be at no cost to the Government. Designers should meet with local fire authorities during early stages of design to incorporate local requirements to the extent practical; however, recommendations made by local officials should be reviewed for adequacy, cost, and nationally accepted practice before being incorporated into project design.

B. VA has adopted the National Fire Codes (NFC) published by the National Fire Protection Association (NFPA), which establish a minimum acceptable level of life safety and property protection. Life safety requirements are specifically addressed in the Life Safety Code, NFPA 101. Where conflicts exist between codes, the designer shall follow the code specified in the text under the subject section of this manual. Fire Protection design shall be based on the latest editions of the NFC at the Date of Award of the contract to the Architectural/Engineering (A/E) firm (or Design/Build firm). Under special circumstances, the VA will require compliance with a more recent code edition when significant changes to the code have occurred between the Date of Award to the A/E and the Date of Award to the prime contractor for construction.

Note: Special circumstances would include a situation where a designed project sat "on the shelf" for an extended period of time, or where a significant change to the code was made and where incorporating that change would improve safety in the opinion of the AHJ.

C. Fire protection features not addressed by the NFC or otherwise addressed by this document shall be designed to comply with the requirements of the latest edition of the International Building Code (IBC). Other references are listed in Appendix B.

D. For design features that are addressed by both the IBC as well as by NFPA 101 or a document referenced by NFPA 101, the requirements of NFPA 101 or the document referenced by NFPA 101 shall be used exclusively (this applies even if the IBC requirements are different).

Note: VA buildings must meet the requirements of NFPA 101 and documents referenced by NFPA 101 in order to comply with the accreditation requirements of the Joint Commission. It is intended that life safety and fire protection features will be designed in accordance with the requirements of NFPA 101 and documents referenced by NFPA 101. Other building features (including, but not limited to, structural strength, stability, sanitation, adequate light and ventilation, and energy conservation) will be designed in accordance with the IBC and documents referenced by the IBC or as identified in VHA Program Guide PG-18-3, Topic 1 – Codes, Standards, and Executive Orders.

E. Strict compliance to codes and standards is mandatory for new construction. If equivalent protection is proposed by the designer for renovations, submit requests and supporting rationale through the respective Network Safety Manager or SFPE to the Safety and Fire Protection Engineer (10NA8) in VA Central Office.

1.4 Fire Protection During Construction:

A. Coordinate with the facility prior to and concurrent with design.

B. Fire protection during construction shall comply with VA Master Construction Specification (VAMCS) 01 00 00, General Requirements. (Note: VAMCS 01 00 00, General Requirements, addresses NFPA 241, Joint Commission Interim Life Safety Measures, Hot Work Permits, etc. This specification section was formerly section 01010.)

C. Separate all occupied areas from demolition, renovation, or construction activities by temporary smoke-tight construction partitions of gypsum board or other approved non-combustible or limited-combustible material. Partitions shall be full height, extending through suspended ceilings to the floor slab or roof deck above and shall be one-hour fire rated, unless sprinklers are installed and are operational on both sides of the temporary partition whereupon the partition may be permitted to terminate at the ceiling in accordance with NFPA 241. Where the ceiling on one side of the temporary construction barrier has been removed, the temporary partition must extend to the deck above.

Note: This requirement is due to the inherently greater potential for fire or hazardous materials incidents associated with the combustibles and operations of demolition/construction. This risk is made worse by the likelihood of compromised fire protection systems and fire/smoke resistant construction. This does not obviate the need to provide other protective measures to contain dust and debris as specified by VAMCS *01 00 00 section 1.8(D)(2). Sprinklers are considered to be operational when they are installed in accordance with NFPA 13 (spacing, protection, distance from the ceiling, etc.) and there is a sufficient automatic water supply. If the ceiling was removed and the sprinklers remain at the original ceiling level, they would likely not be considered operational.*

D. Phase construction as necessary to ensure that obstruction of exits is minimized or avoided. If exits are obstructed during construction, provide alternate exit routes during each phase of construction and identify the alternate routes on the construction drawings.

E. Minimize or avoid disruptions to fire alarm and sprinkler systems. Delineate phasing of construction to ensure that installations of new systems are expedited, and where possible, maintain existing systems in service until the replacement system is operational. If fire protection systems are to be disrupted, ensure procedures are incorporated to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down.

1.5 Americans with Disabilities Act (ADA): Fire Protection requirements of ADA do not apply to federal agencies; however, VA is required to comply with the ABA (Architectural Barriers Act) Accessibility Standard for Federal Facilities.

2. BUILDING FEATURES

2.1 Types of Construction:

A. For each construction type, design fire resistive ratings of structural members in accordance with NFPA 220.

B. For other than parking garages, comply with the following:

1) For buildings where NFPA 101 provides construction requirements for one or more of the occupancies within the building, the type of construction as well as the height for the building shall comply with the most restrictive occupancy construction requirements of NFPA 101.

2) For buildings where NFPA 101 does not provide construction requirements for any of the occupancies within the building, the construction type as well as height and area limitations for the building shall comply with the requirements of the IBC.

Note: The height and area limitations found in the IBC will apply only to those buildings where all occupancies within the building have no construction requirements in NFPA 101. For example, use of the IBC will restrict the height and area of a Type V building containing a business occupancy while NFPA 101 would permit the building to be of unlimited height and area. Typically, new construction in the VA will require the building to be sprinkler protected and the limitations in the IBC for fully sprinkler protected buildings should not be overly restrictive.

C. For parking garages, the construction type as well as height and area limitations shall be as follows:

1) Portions that are open parking structures, as defined in NFPA 88A, shall be in accordance with NFPA 88A.

2) Portions that are enclosed parking structures, as defined in NFPA 88A, shall be in accordance with the IBC.

2.2 Building Separation:

A. For other than parking garages, the requirements for fire resistance ratings of exterior walls, maximum area for exterior wall openings, and opening protection shall comply with the IBC (see Note 1) except as follows:

1) There are no requirements for separation or openings between VA buildings when both (all) buildings are fully sprinkler protected (see Notes 2 and 3). This exception does not apply to VA buildings that are adjacent to non-VA property lines.

2) As permitted under Section 2.9 of this design manual.

Note 1: Building separation requirements are found in Table 602 and opening requirements are found in Table 705.8 of the 2009 Edition of the IBC. With greater than 60 feet of separation between buildings (or greater than 30 feet of separation between a building and a property line), there are no requirements in the IBC. With ≤ 60 feet of separation between buildings (or ≤ 30 feet of separation between a building and a property line) and where any one building is not fully sprinkler protected, the requirements in the IBC must be followed.

Note 2: Buildings that are sprinkler protected throughout are not considered to be an exposure hazard in accordance with NFPA 80A.

Note 3: If buildings touch each other, additional requirements might apply. (i.e. construction type, occupancy separation, etc.)

B. For parking garages, building separation and requirements for rated exterior walls and openings shall comply with the requirements of NFPA 88A.

2.3 VA Hospital Building System (Interstitial): Fire protection requirements for facilities designed using the VA Hospital Building System (VAHBS) shall comply with the following:

A. Design walk-on decks in accordance with the lightweight insulating concrete assembly tested and reported in NBSIR 85-3158 or NISTIR 5560, except that sprayed fire-resistive material protecting the bottom of purlins supporting walk-on decks shall be sprayed to a minimum thickness of one-inch with fireproofing suitable for exposed applications. Wire mesh may be omitted from the bottom flange of the purlins supporting the deck.

B. Steel in interstitial space supporting functional floors shall not be fireproofed, with the exception of columns, which are sprayed throughout their entire height, and structural members supporting mechanical room floors (required to maintain continuity of the two-hour membrane separating interstitial spaces from functional floors). Clearly identify these features on design details and in specifications.

C. Two-hour fire resistance rating is required between floors; the separation runs in a horizontal plane along the mechanical equipment room floor, then vertically along the wall separating the mechanical equipment room from functional spaces, then it continues along the interstitial deck. Columns, girders, and trusses supporting more than one floor within interstitial spaces and structural members in the mechanical room shall also have two-hour fire resistance rating.

D. Interstitial space need not be subdivided horizontally into fire or smoke compartments. Horizontal exits or smoke barrier walls located below in occupied space need not be extended up into interstitial space.

E. In interstitial space, a fire resistive rating is only required for two-hour fire rated shafts (elevators, chases, stairs, etc.) and one-hour rated mechanical equipment rooms adjacent to interstitial spaces.

F. Neither fire nor smoke dampers are required where ducts penetrate the one-hour rated partition separating the mechanical room from the interstitial space; however, smoke dampers are required at air handlers to comply with NFPA 90A. Fire dampers are not required in ducts for openings in the interstitial deck less than 150,000 sq. mm (225 sq in), including supply ducts from interstitial spaces to functional spaces, exhaust ducts, and return ducts from functional spaces into the interstitial space. Flexible duct work (UL 181, Class I) is permitted in interstitial space for connections less than 2.4 m (8 ft) long and shall be no larger than 300 mm (12 in) diameter.

G. Protect horizontal and vertical penetrations (ducts, cables, pipes, etc.) with through penetration protection systems.

H. Provide fire alarm pull stations at exit doors from interstitial spaces and sufficient notification appliances so a fire alarm signal can be received throughout the spaces.

I. Provide exit signs at exit doors and other locations to provide clear direction toward exits from interstitial spaces. Provide emergency lighting for adequate egress illumination in the event of a power outage.

2.4 Interior Finish:

A. Wall and ceiling finishes and movable partitions shall conform to NFPA 101.

B. Interior floor finish shall conform to NFPA 101.

2.5 Site Considerations:

A. Provide access for emergency vehicles to new buildings and additions in accordance with NFPA 1.

B. Design roads, fire lanes, and turn-arounds for the weight and turning radius of fire apparatus. Consult local fire department for fire apparatus requirements. At minimum, one of the long sides of every building shall be accessible to fire department equipment.

2.6 Insulation, including foam plastic: Comply with IBC.

2.7 Roof Coverings and Roof Deck Assemblies:

A. Roof coverings shall be approved or listed by a nationally recognized testing laboratory for compliance with UL standard 790 and shall be Class B minimum.

B. Roof deck assemblies shall be FM Class I approved, or shall be UL listed as Fire-Classified.

2.8 Roof Access: Comply with IBC.

2.9 Shelters, pavilions, or similar structures located near health care buildings:

A. Shelters or pavilions with automatic sprinkler protection are not considered to present an exposure hazard. However, if of wood-frame construction, they may not be attached directly to a permanent building.

B. Locate non-sprinklered combustible structures or non-sprinklered structures that have combustible roof assemblies a minimum of 7.5 m (25 ft) from the exposed building. The 7.5 m (25 ft) separation may be reduced to 0 when the exposed (permanent) building has at least a two-hour fire resistive rating and has no openings (windows, doors, or roof) within 7.5 m (25 ft) of the temporary structure; to 3 m (10 ft) when the exposed wall has a two-hour fire resistive rating and all openings within 7.5 m (25 ft) of the temporary structure are protected with one-hour protection; and to 4.5 m (15 ft) when all openings in the two-hour fire resistive rated exposed wall are protected with 3/4 hour rated assemblies.

C. Because it is difficult to ignite polycarbonate and aluminum (bus stop type) shelters and they are likely to collapse shortly after becoming fully involved in a fire, they are given special consideration. Polycarbonate and aluminum shelters located next to buildings with automatic sprinkler protection shall be located 3 m (10 ft) or more from any unprotected openings. Such shelters located next to buildings without automatic sprinkler protection shall be located 6 m (20 ft) or more from any unprotected openings.

D. Shelters or pavilions that are of masonry construction shall not be located within 3 m (10 ft) of any building opening.

2.10 Fire and Smoke Barriers: Fire and Smoke barriers shall be provided as required by NFPA 101. In accordance with PG-18-15, fire and smoke barriers shall be shown on all drawings. Specifically indicate the hourly rating of every barrier. Where possible, smoke barriers should not be configured to include corridor doors.

Note: Corridor walls and smoke barriers have different requirements.

2.11 Protection of Openings: Openings in fire rated barriers shall be protected according to NFPA 101, 80, and 90A. Doors in such openings shall be normally closed, unless equipped with electromagnetic door hold open devices arranged to close upon activation of the fire alarm system or smoke detector installed proximate to the door. Fire shutters shall be provided to protect openings in fire rated barriers designed to be normally open. Shutters shall be designed to close upon activation of a smoke detector proximate to the shutter. Such detectors shall close all shutters within a fire barrier served. Closing speed shall be in accordance with NFPA 80. Fire dampers shall be installed in fire rated barriers in accordance with NFPA 90A. Fire rating glazing, where used, shall meet applicable safety standards.

Note: Shutter includes rolling steel fire doors as well as service counter doors.

2.12 Suites: Corridor doors accessing suites in health care occupancies shall latch except power operated doors as identified in the Life Safety Code.

Note: The intent of this requirement is to ensure corridor doors accessing suites are equipped with latches just like other corridor doors. This would apply even if the suite doors were part of a smoke barrier, though this configuration is not advised. Often, operating room, ICU and recovery room suite doors are double leaf power operated automatic doors that do not normally latch. As of the 2009 Edition of the Life Safety Code, these doors do not have to latch provided there is 5lbf at the latch edge that will keep the door closed.

2.13 Exit Signs:

A. Two exit signs are not required to be visible in an exit access corridor (see Healthcare Interpretations Task Force (HITF) 98-7).

B. Exit signs with tritium are not permitted in VA facilities.

Note: Possession of tritium exit signs brings upon the facility legal responsibilities for compliance with Nuclear Regulatory Commission (NRC) regulations.

2.14 Door Locking Requirements: Doors are permitted to be locked in the direction of egress travel under conditions as identified in NFPA 101 (2009) as follows:

A. Delayed Egress (7.2.1.6.1) where permitted by the occupancy chapter.

B. Access Controlled (7.2.1.6.2) where permitted by the occupancy chapter.

C. Elevator Lobbies (7.2.1.6.3) where permitted by the occupancy chapter.

D. For the safety of the patients in healthcare occupancies

1) Patient room doors (18/19.2.2.2.2)

2) Means of egress for the <u>clinical needs</u> of the patients (18/19.2.2.2.5.1)

Where the permission to lock doors in accordance with NFPA 101, 18/19.2.2.2.5.1 is used, NFPA 101, 18/19.2.2.2.6 requires the following:

Doors that are located in the means of egress and are permitted to be locked under other provisions of this chapter shall have provisions made for the rapid removal of occupants by means such as the follows:

Option A. Remote control of locks

Option B. Keying of all locks to keys carried by staff at all times

Option C. Other such reliable means available to the staff at all times.

VA Clarification for Options A, B, and C above:

For Option (A): The locked doors are required to be in the line of sight of the location of the remote operator.

For Option (B): Self evident

For Option (C): Card access security systems may be used provided that a mechanical key release is provided such that when the key is operated, it will directly interrupt the power to the locking mechanism independent of the card access system electronics and staff in the area carry keys at all times.

3) Means of egress where <u>patient special needs</u> require specialized protective measures (18/19.2.2.2.5.2)

Note: This locking permission was added in the 2009 edition of the Life Safety Code especially for pediatric wards. Pediatric wards were being locked to prevent babies from being stolen and the locking was not truly for the clinical needs of the patients. The use of section 18/19.2.2.2.5.2 should rarely be used in the VA since the doors could be locked under the less stringent requirements for clinical reasons on 18/19.2.2.2.5.1.

Addition criteria from NFPA 101 as follows {(1) through (5)(b) copied verbatim} is required to use this arrangement.

(1) Staff can readily unlock doors at all times in accordance with 18/19.2.2.2.6.

(2) A total (complete) smoke detection system is provided throughout the locked space in accordance with 9.6.2.9, or locked doors can be remotely unlocked at an approved, constantly attended location within the locked space.

(3)The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 18/19.3.5.1.

(4) The locks are electrical locks that fail safely so as to release upon loss of power to the device.

(5) The locks release by independent activation of each of the following:

(a) Activation of the smoke detection system required by 18/19.2.2.2.5.2(2)

(b) Waterflow in the automatic sprinkler system required by 18/19.2.2.2.5.2(3)

Where the permission to lock doors in accordance with NFPA 101, 18/19.2.2.2.5.2 is used, NFPA 101, 18/19.2.2.2.6 requires the following:

Doors that are located in the means of egress and are permitted to be locked under other provisions of this chapter shall have provisions made for the rapid removal of occupants by means such as the follows:

Option A. Remote control of locks

Option B. Keying of all locks to keys carried by staff at all times

Option C. Other such reliable means available to the staff at all times.

VA Clarification for Options A, B, and C above:

For Option (A): The locked doors are required to be in the line of sight of the location of the remote operator.

For Option (B): Self evident

For Option (C): Card access security systems may be used provided that a mechanical key release is provided such that when the key is operated, it will directly interrupt the power to the locking mechanism independent of the card access system electronics and staff in the area carry keys at all times.

4) Doors in non-healthcare occupancies for the safety of patients (18/19.1.2.6)

Note: From the NFPA 101 Handbook: Health care occupancy patients are sometimes moved to nonmedical areas — such as a chapel for religious services or an auditorium for recreation — that typically do not meet the provisions applicable to health care occupancies. Paragraph 18/19.1.2.6 permits such areas to be regulated by the provisions applicable to the corresponding occupancy (which would be an assembly occupancy, in the case of chapels or auditoriums). This paragraph addresses a subject similar to that addressed in 18/19.1.2.7 but adds the requirement that, where the clinical needs of the occupants necessitate the locking of doors, staff must be present for the supervised unlocking of doors and release of occupants. This additional requirement ensures that procedures are in place for the ready release of occupants.

3. SPECIAL PROTECTION

3.1 Storage:

A. Storage rooms shall be considered hazardous areas and shall comply with appropriate occupancy chapter requirements of NFPA 101.

Note: It is not the intent to require protection for storage rooms that is greater than the protection required by the Life Safety Code. A storage room may be classified as a hazardous area in one occupancy chapter and not be considered a hazardous area in another occupancy chapter.

B. Rooms containing medical records storage or moveable-aisle/mobile shelving shall be provided with automatic sprinkler protection and enclosed with a barrier having a one-hour fire resistance rating. Also see Section 6.1E.

3.2 Flammable and Combustible Liquid Storage:

A. Comply with NFPA 30.

B. Provide adequate space for flammable and combustible liquid storage cabinets.

3.3 Food Preparation Facilities: Provide fixed fire extinguishing systems for cooking operations in accordance with NFPA 96. Activation of the fire suppression system shall shut down the power/fuel source to the cooking equipment and shall be connected to the building fire alarm system. Fire protection systems shall be wet chemical type and shall comply with UL300 in accordance with NFPA 17A.

3.4 Compressed Gas/Cryogenic Liquid Storage:

A. Location, construction, and arrangement of compressed medical gas storage areas shall comply with NFPA 99.

B. Bulk oxygen supply systems or storage locations having a total capacity of more than 566 cu m (20,000 cu ft) of oxygen shall comply with NFPA 50.

C. Liquid oxygen storage tanks shall not be located on or within 4.5 m (15 ft) of asphalt or bituminous pavement. Provide non-combustible joints and crack fillers around these tanks.

3.5 Laboratories:

A. Do not locate laboratories containing Class I flammable liquids in basements.

Note: Class I flammable liquids are not permitted in basements and are not permitted to be stored in basements, per NFPA 30, 2008 edition, sections 9.3.6 and 9.7.3.

B. Laboratories using flammable or combustible liquids in buildings with inpatients, or outpatients incapable of self-preservation shall comply with NFPA 99. These laboratories shall be enclosed with a barrier having a one-hour fire resistance rating.

Note: The type and quantities of flammable liquids are subject to change during the life of the laboratory. For this reason, the added protection of a one-hour fire rated enclosure has been added.

C. Other laboratories using flammable or combustible liquids shall comply with NFPA 45.

3.6 Casework (including non-moveable, built-in cabinetry, wardrobe, etc.):

A. No restrictions in buildings provided with automatic sprinkler protection.

B. Provide metal casework in non-sprinklered buildings in patient care rooms.

3.7 Information Technology Telecommunication, and High Cost Equipment Rooms:

A. Mission-essential information technology, telecommunication, and high cost equipment rooms and infrastructure, with the potential for high dollar loss and/or business interruption, shall be provided with wet pipe automatic sprinkler protection and shall be designed to comply with NFPA 75 as described in this design manual.

B. Additional guidance is provided in PG-18-3, VA Design and Construction Procedures, Topic 10.

C. Head End Equipment Rooms as defined in the VA Electrical Design Manual shall be provided with sprinkler protection and smoke detection.

D. Telephone Equipment Rooms (TER) and Main Computer Rooms (MCR) as specified in the VA Electrical Design Manual are to be designed in accordance with Section 3.7 E, Data Centers. A Telephone Equipment Room is to be considered a Tier I facility.

E. Data Centers:

1. Tier I, Tier II, Tier III and Tier IV data centers are defined in "Data Center Standards," April 2004, VHA Enterprise Management Center, Office of Information. The following is extracted from that document:

Tier I Data Center
Basic

A Tier I data center is susceptible to disruptions from both planned and unplanned activity. It has computer power distribution and cooling, but it may or may not have a raised floor, a UPS, or an engine generator. If it does have UPS or generators, they are single-module systems and have many single points of failure. The infrastructure should be completely shut down on an annual basis to perform preventive maintenance and repair work. Urgent situations may require more frequent shutdowns. Operation errors or spontaneous failures of site infrastructure components will cause a data center disruption.

Tier II Data Center
Redundant Components

Tier II facilities with redundant components are slightly less susceptible to disruptions from both planned and unplanned activity than a basic data center. They have a raised floor, UPS, and engine generators, but their capacity design is "Need plus One" (N+1), which has a single-threaded distribution path throughout. Maintenance of the critical power path and other parts of the site infrastructure will require a processing shutdown.

Tier III Data Center
Concurrently Maintainable

Tier III level capability allows for any planned site infrastructure activity without disrupting the computer hardware operation in any way. Planned activities include preventive and programmable maintenance, repair and replacement of components, addition or removal of capacity components, testing of components and systems, and more. For large sites using chilled water, this means two independent sets of pipes.

Sufficient capacity and distribution must be available to simultaneously carry the load on one path while performing maintenance or testing on the other path. Unplanned activities such as errors in operation or spontaneous failures of facility infrastructure components will still cause a data center disruption. Tier III sites are often designed to be upgraded to Tier IV when the client's business case justifies the cost of additional protection.

Tier IV Data Center
Fault Tolerant

Tier IV provides site infrastructure capacity and capability to permit any planned activity without disruption to the critical load. Fault-tolerant functionality also provides the ability of the site infrastructure to sustain at least one worst-case unplanned failure or event with no critical load impact. This requires simultaneously active distribution paths, typically in a System+System configuration. Electrically, this means two separate UPS systems in which each system has N+1 redundancy. Because of fire and electrical safety codes, there will still be downtime exposure due to fire alarms or people initiating an Emergency Power Off (EPO). Tier IV requires all computer hardware to have dual power inputs as defined by the Institute's Fault-Tolerance. Tier IV site infrastructures are the most compatible with high availability IT concepts that employ CPU clustering, RAID DASD, and redundant communications to achieve reliability, availability, and serviceability.

Current Vista facility data centers would fall into the first three tiers, with some being Tier-I and very few at the Tier-III level. Ultimately, VA data center facilities should achieve an acceptable level of confidence (tier) within the VA's infrastructure in order to support enterprise-level systems such as HealtheVet systems. In order to establish and implement a minimum level of standards for VA data centers, a base set of standards must be established and used in a survey of facility data centers.

2. Tier I, II, III, and IV data centers shall be provided with wet pipe automatic sprinkler protection in accordance with NFPA 13. Sprinkler protection shall be installed utilizing standard response fusible link sprinklers.

   Note: Standard response fusible link sprinklers will lessen the chance of a sprinkler being accidentally broken and will still provide structure protection since a standard response head is more robust and harder to break that a typical glass bulb quick response sprinkler.

3. Tier I, II, III, and IV data centers shall be protected with a gaseous fire suppression system when required by NFPA 75. Note that a gaseous fire suppression system is in addition to, and does not replace, the required wet pipe automatic sprinkler system.

   Note: NFPA 75 provides risk criteria to establish the need for gaseous systems. Generally, Tier I systems would not require a gaseous system.

3.8 Paint Spray Areas: Comply with NFPA 33.

3.9 Atrium Smoke Control Systems: Comply with NFPA 92B. See the VA Design Manual for HVAC systems for additional design criteria.

3.10 VA Canteen Retail Stores: Retail stores located in health care occupancies shall be considered as hazardous areas and shall therefore be separated from adjacent spaces by one-hour fire rated construction.

3.11 Pharmacies: Pharmacies located in health care occupancies shall be considered storage areas and shall therefore be separated from adjacent spaces by one-hour fire rated construction. Fire or service counter shutters shall be provided to protect openings where medication is dispensed or other transactions occur.

3.12 Chutes: Linen chutes and waste chutes shall comply with the provisions in NFPA 82 for limited access gravity chutes.

3.13 Parking Garages: Parking garages shall comply with the provisions in NFPA 88A except for construction type, height and area limitations, and building separation, which shall comply with 2.1. and 2.2 of this manual.

4. OCCUPANCY CLASSIFICATION

4.1 General: Occupancy classifications are defined in NFPA 101 and as follows:

See also the attached file for occupancy determination. (Included at end of this document.)

Health Care Chapter 18 & 20	**Business** Chapter 38	**Residential** Chapters 26, 28, 30 & 32	**Industrial** Chapter 40	**Day Care** Chapter 16
Hospitals	Psychiatric Outpatient Clinics	Blind Rehabilitation	Research Buildings	Child Day Care
Nursing Homes	Alcohol/Drug Outpatient Facilities	Alcohol/Drug (4)	Free Standing Laundries	Adult Day Care
Ambulatory Health Care Facilities (1)	Methadone Maintenance Clinics	Domiciliaries (5)	Power Plants	Day Treatment Centers
Alcohol/Drug (3)	Ambulatory Health Care Facilities (2)	Quarters Buildings, Hoptels	Free Standing Shops	
Domiciliaries (5)	Administrative Offices & Sleep Labs	Homeless Shelters		

(1) Includes surgery centers, dialysis centers, imaging centers and cardiac catheterization centers

(2) Includes buildings with occupants capable of self preservation

(3) Medical detoxification facilities for Alcohol/Substance Abuse

(4) Social detoxification facilities for Alcohol/Substance Abuse

(5) Where staffing patterns do not meet health care requirements, Domiciliaries shall be protected in accordance with the appropriate residential occupancy requirements.

Note: Domiciliaries are surveyed by Joint Commission utilizing occupancy chapters 28 and 29 (Hotel/Motel/Dormitories) of the Life Safety Code. These chapters are often less representative than the Board and Care occupancy chapters for domiciliaries in the VA. Door closers are required on corridor rooms in the chapters that the Joint Commission follows, while exceptions for the omission of closers may exist for the board and care occupancies. However, Joint Commission has granted a VA-wide equivalency for the closers when the following features are present: (1) sprinkler protection, (2) single station smoke alarms are provided for the sleeping rooms, (3) staff is present and trained to close doors, (4) fire drills are conducted, and (5) the fire alarm system is connected to transmit a signal to the fire department. Where the board and care occupancy chapters are followed, an equivalency may have to be obtained from Joint Commission to prevent the facility from receiving a type I recommendation from Joint Commission for the lack of door closers on sleeping room doors.

4.2 Multiple Occupancies: Buildings containing multiple occupancies shall be considered mixed or separated as required by NFPA 101. Buildings containing occupancies that are not incidental to the primary occupancy shall comply with the most restrictive requirement of the occupancies involved, unless separated by barriers having fire resistance ratings as required by NFPA 101.

Note: Hoptels are locations in which lodging accommodations, similar to a hotel, are provided. Determination of occupancy classification of Hoptels located in health care occupancies should be done on a floor or area basis when calculating occupant loads of sleeping residents. Requirements for corridor wall construction or sleeping room door closers should be evaluated for an equivalent approach, See the following table (note 7) for guidance. Hoptels within health care occupancies may be considered part of the health care occupancy provided staff is responsible for ensuring safe relocation and/or evacuation of residents.

Hoptels and the Life Safety Code (2009 Ed.)

Number of Occupants Sleeping [1]	Life Safety Code - Occupancy Chapter	Construction Requirements	Corridor requirements	Rated Corridor Door	Closer Required	Latching Required	Smoke detection in corridor required?	Single Station Smoke Alarm Required? [2]	Direct Connection to FD required?	Other [3, 4]
NA	Ch.19 [5] without sprinklers	Yes	1/2 hour	20 minute equivalent	No	Yes, or closing device to keep the door closed.	No	No	Yes	
NA	Ch. 19 [5] with sprinklers	Yes	Smoke resistant	20 minute equivalent	No	Yes, or closing device to keep the door closed.	No	No	Yes	
>16	Ch. 28 without sprinklers [6]									
>16	Ch. 28 with sprinklers [6]	None	1/2 hour [7]	20 minutes [8]	Yes	Yes	No	Yes	Yes	
≤16	Ch. 26 without sprinklers [9]									
≤16	Ch. 26 with sprinklers	None	Smoke resistant	No	No	Yes, or closing device to keep the door closed.	No	Yes	No	
≤ 3	Ch. 24 [10] without sprinklers	None	None	No	No	No	No	Yes	No	
≤ 3	Ch. 24 with sprinklers	None	None	No	No	No	No	Yes	No	

[1] This should be addressed on an area basis (i.e., if there are multiple floors in a health care building, treat each zone/floor separately). This table assumes that the Hoptel is going into an existing health care occupancy. Where separate buildings are provided, they shall comply with the appropriate chapter in the Life Safety Code. See footnote 10.
[2] In guest rooms which have been specifically designed for the hearing impaired, a visible fire alarm signal shall be provided.
[3] Signage including a floor plan shall be provided on the guest room doors to explain emergency egress for the floor/area. Fire safety information shall be provided to all residents to explain emergency egress actions.
[4] All residents should be advised of the medical center smoking policy. For buildings with non-residential occupancies, the building fire plan must be revised to reflect that some of the occupants are residents sleeping overnight.
[5] Health care chapters are provided for comparison purposes only.
[6] New Hotels and Dormitories are required to be sprinklered throughout with QR heads (See NFPA 101, 28-3.5).
[7] The corridor walls are required to extend from floor slab to floor slab, or, if the Hoptel is located within a sprinklered health care occupancy, the walls may terminate at a smoke resistant ceiling. Health care occupancies have minimum construction requirements as well as an automatic response from emergency forces that compensate for the wall not extending slab to slab.
[8] Existing 1-3/4 inch solid bonded wood core doors are considered equivalent to 20 minute doors and are acceptable.
[9] New Lodging and Rooming Homes are required to be sprinklered.
[10] Chapter 24 shall not be used for Hoptels located within health care occupancies. As a minimum, the requirements in Chapter 26 shall be followed for Hoptel rooms located in health care occupancies.

5. WATER SUPPLY FOR FIRE PROTECTION

5.1 Adequacy of Water Supply: Assess adequacy of the existing water supply. Perform water supply flow testing of fire hydrants and/or fire pumps. If data is available from the facility, the designer must verify the locations involved as well as the quality and accuracy of the data.

A Provide a secondary fire suppression water supply if required in either of the Physical Security Design Manuals for VA Facilities.

Note: VA has published two Physical Security Design Manuals that cover Mission Critical Facilities and Life Safety Protected Facilities. As of 3/2011, only the Mission Critical Facilities are required to have a secondary water supply for fire protection.

B. Design the secondary water supply to meet the largest expected fire demand (sprinkler system plus fire hose requirements) for the duration specified in paragraph 5.4. See also 5.2 below and the capacity requirement of the Physical Security Design Manual.

C. Water storage tanks shall be designed in accordance with NFPA 22 “Standard for Water Tanks for Private Fire Protection.”

D. New water storage tanks shall be provided with a high and low level water switches that are connected to the site fire alarm system and initiate supervisory alarm signals.

5.2 Capacity:

A. Non-Sprinklered Buildings: Provide minimum fire flow as shown in Table 5.0. Partially-sprinklered buildings shall be considered non-sprinklered. Typical building occupancies are shown for each NFPA 13 hazard classification. Flow demand depends primarily on the type of construction, occupancy, exposure to the building, access to the building site, and fire department response. Fires in non-sprinklered buildings require more water because application of water by fire department hose streams is less efficient and begins later than sprinklers. Use professional judgment to modify these requirements on a case-by-case basis depending on the following favorable and unfavorable conditions:

Note: It is recommended that any deviations be forwarded to the respective SFPE for review prior to incorporating the modification.

1. Favorable Conditions
    a. Non-combustible construction
    b. Limited exposures
    c. Ready access to entire building site by fire department apparatus
    d. Quick response by adequately staffed fire department
2. Unfavorable Conditions
    a. Combustible construction
    b. Moderate or serious exposures
    c. Hindrance to fire department apparatus access to building site
    d. Delayed response or inadequately staffed fire department

Table 5.0 - Minimum Fire Flows for New Non-Sprinklered Facilities and New Underground Water Systems (at 138 kPa (20 psi)).

NFPA 13 Hazard Classification	Favorable Conditions	Unfavorable Conditions
Light Hazard Patient Buildings, Offices, Quarters	79 L/s (1250 gpm)(1)	95 L/s (1500 gpm)
Ordinary Hazard Laboratory Buildings, Shops, Laundries	79 L/s (1250 gpm)(1)	126 L/s (2000 gpm)
Extra Hazard Warehouses	95 L/s (1500 gpm)	190 L/s (3000 gpm)

(1) Based on the minimum required by NFPA 14 and fire department pumper capacities.

B. Sprinklered Buildings: The required fire flows and pressures for buildings provided with automatic sprinkler protection shall comply with NFPA 13 and other applicable NFPA standards. Also provide a minimum hose stream allowance for total combined inside and outside fire fighting to comply with NFPA 13.

5.3 Fire Pumps:

A. When a fire pump is necessary to supplement fire flow and pressure, size it to comply with NFPA 13 and 14. Where hose is not installed or otherwise provided in the facility, the fire pump will be sized only for the sprinkler system requirements. The local responding fire department will provide the necessary flow and pressure for manual fire fighting operations. The capability of the fire department to handle the manual fire fighting requirements shall be verified and documented.

Note: Standard operating procedures for most fire departments do not allow fire fighters to use occupant hose lines within buildings since the fire fighters are generally not aware of the condition of the hose, and use of the hose could potentially result in a dangerous situation. Fire department procedures also generally require fire fighters to connect a pumper truck to the fire department connection to augment the pressure to the sprinklers and standpipes. Hence it is the VA position that the building fire pump be sized only for the sprinkler system demand and to let the fire department supply the flow and pressure for manual fire fighting. The fire pump should be sized to handle manual fire fighting requirements in NFPA 14 only where the fire department pumper truck cannot provide the necessary pressure, and this is not anticipated at any VA facility. The designer must verify that the fire department can adequately supply the manual fire fighting requirements.

B. Separate fire pumps from all other areas of the building by fire resistant rated construction in accordance with NFPA 20. In new construction the fire pump shall be in a separate room from other mechanical and electrical equipment.

C. Design the fire pump installation to comply with the details in the Appendix to NFPA 20. Provide a test header and a flow meter. The test header is to be piped to an exterior straight type header that can be tested without damaging landscaping, etc. Provide a bypass with normally open valves. All fire pump system valves shall be electrically supervised by tamper switches. However, padlocks and chains may be substituted in lieu of tamper switches for normally closed valves on a case by case basis.

D. Pumps shall start automatically at 69 kPa (10 psi) below jockey pump start pressure. Pumps shall be manually shut down.

Note: Manual shut down of the fire pump will ensure that the pump does not shut down prematurely before controlling the fire. In addition, someone at the facility should go to the fire pump upon alarm to ensure that it is operating properly. NFPA 20 does not permit automatic shutdown where the fire pump constitutes the sole source of water for a sprinkler or standpipe system.

E. Pumps shall be electric motor driven, horizontal split case centrifugal type unless this is not feasible. Power transfer switch and fire pump controller shall be factory assembled and packaged as a unit. Separate transfer switches are not permitted. Controller shall be monitored by the fire alarm system. Protect feeder circuit to comply with NFPA 20.

F. Provide primary and emergency power to fire and jockey pumps protecting health care occupancies serving inpatients from the life safety branch of the essential electrical system as defined in NFPA 70.

G. Provide jockey pumps to supply no less than 3.8 L/s (60 gpm). This will allow the jockey pump to supply the flow equivalent of one sprinkler to permit water flow switch testing and will permit tests to be performed without shutting down the fire pump. The jockey pump shall maintain pressure as required to prevent the fire pump from operating to maintain system pressure.

Note: Assuming a pressure of 125 psi is maintained on a system, a 60 gpm jockey pump will provide enough water to handle the water flow testing of the flow switches without the need to shut down the fire pump. Some installations with fire pumps cannot test water flow switches without shutting down the fire pump due to hammering open dry pipe valves or discharging water onto roads or sidewalks during the winter seasons. A larger jockey pump ensures that the fire pump will be in service when needed.

H. Design electrical feeders to the fire pump to comply with NFPA 20. Feeders shall be outside the building except in the fire pump room and electrical room of origin.

I. Relief valves, where installed, shall discharge to the atmosphere and shall not be recirculated back to the suction side of the fire pump

5.4 Duration:

A. Non-Sprinklered Buildings: Fire flows as required by Table 5.0 shall be available for a duration of 60 minutes minimum for favorable conditions and 120 minutes minimum for unfavorable conditions (see Section 5.2).

B. Sprinklered Buildings: Fire flows shall be available as required by NFPA 13 for the required occupancy classification. However, duration for health care occupancies shall not be less than 60 minutes.

5.5 Distribution System: Installation shall comply with NFPA 24 and NFPA 1141 except as follows:

A. Mains shall be 200 mm (8 in) minimum. Mains supplying only fire hydrants (laterals) shall be permitted to be 150 mm (6 in).

B. Provide valves in underground water distribution lines to isolate leaks and to allow water to supply the remainder of the loop. Locate isolation valves so that not more than four discharge points (sprinkler systems, hydrants, or standpipe systems) will be taken out of service by any one break in the line.

C. To increase available water flow and reliability, loop water distribution piping and provide dual feeds when cost effective. Avoid dead-end mains. A second connection to the public water utility system or an elevated water tank may be needed in order to provide redundancy.

5.6 Hydrants: Design installation to comply with NFPA 24 and NFPA 1141 except as follows:

A. Contact the responding fire department for hydrant requirements.

B. Maximum spacing between hydrants shall not exceed 300 ft. Locate hydrants such that every portion of the exterior of every building shall be within 300 ft of a hydrant, with consideration given to accessibility and obstructions. When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R (as applicable), the distance from the exterior of the building shall be permitted to be increased to 450 ft. Nominal distance between a fire hydrant and the building fire department connection shall be 50 ft.

C. Wet barrel hydrants are preferred where piping is not subject to freezing.

D. Valve all hydrant connections at the supply main.

E. Locate hydrants adjacent to paved areas, no closer than 3 ft and no farther than 7 ft from roadway shoulder or curb line, accessible to fire department apparatus. Barrels shall be long enough to permit at least 18 inches clearance between center of pumper connection and grade. Pumper connection shall be perpendicular to street to allow straight line connection to pumper.

F. Protect hydrants located adjacent to parking areas or other vehicle traffic areas by bollards.

G. Design site grading for surface drainage away from hydrant.

H. Mark hydrants to comply with NFPA 291 if local fire department has no preference.

5.7 Signage: Furnish appropriate signage for all post indicator valves, fire department connections, and sectional valves. Signage shall indicate specific building and/or zone/area served.

6. FIRE EXTINGUISHING SYSTEMS

6.1 Sprinkler Systems:

A. Automatic sprinkler systems shall be installed for any of the following:

1. When required to meet the goals or objectives stated in the Introduction to this document including the following:

   a. So that critical operational functions are not interrupted for longer than 24 hours; or

   b. So that the loss of real or personal property does not exceed $500,000.00.

2. When required by Section 1 of this document.

B. Installation shall comply with NFPA 13, NFPA 13R, or NFPA 13D as applicable, except as indicated in 6.1.B through 6.1.R.

1. In NFPA 13 systems, sprinkler protection shall be provided in all spaces including, but not limited to, elevator machine rooms, walk-in freezers and cold rooms, computer rooms, telephone switch rooms, radiology and MRI suites, loading docks, electrical rooms*, plumbing or utility closets, audiometric booths, vaults, paint spray booths, dry type lint collectors, dust collectors, and generator rooms. Exception: Sprinklers are not required where specifically exempted by NFPA 13, 13R, and 13D, and as specified in paragraphs 6.1.B.2 and 6.1.B.3 below:

* *Note: While NFPA 13 allows the omission of sprinkler protection in electrical rooms within buildings under specific conditions, the VA does not permit the use of this exception. The VA requires sprinkler protection in all electrical rooms except stand alone buildings dedicated to electrical service where applicable FM data sheets are followed.*

2. Sprinklers are not required in interstitial spaces, except

   a. Sprinklers are required in electrical closets, signaling rooms, etc., located within interstitial spaces, and

   b. A single line of sprinklers is required above the tracks of electric track vehicle systems (ETVS) in interstitial spaces.

3. New audiometric booths installed in a sprinkler protected building shall be protected with sprinklers since they are occupiable spaces within a sprinkler protected building. Existing audiometric booths without sprinkler protection may be permitted to be kept in service without sprinkler protection provided the booths are constructed and listed with a one-hour fire rating, and are equipped with 45-minute self- or automatic- closing doors.

   Note: Field experience has shown that self-closing audiometric booth doors frequently do not operate properly so that the doors do not close completely. Where it is unlikely that the doors can be made to operate properly, sprinkler protection should be provided.

4. CPVC piping shall not be used in the VA except that CPVC piping may be used in Type V (wood construction) residential applications if there are no fire or smoke barriers and permission is obtained in writing from the Chief Engineer.

Note: Numerous chemicals typically found in commercial construction are known to be incompatible with, and detrimental to, CPVC pipe and fittings. Some chemicals have been shown to be the cause of failure of the CPVC piping. The continuous effort required for the life of the installed system to police all of the chemicals that may affect the CPVC piping makes this piping material a bad choice for use in the VA.

Typically, in Type V residential applications most of the piping will be installed in concealed spaces and incompatible chemicals are less likely to be found in this type of construction. Fire and smoke barrier penetrations need to be sealed and the known compatibility issues with fire barrier sealants would make CPVC use an unwise choice . See the documents and links below (also included at end of this document):

CPVC Chemical Compatibility

Potential Damage to CPVC Fire Sprinkler Systems From Spray Foam Insulation

Potential Damage to CPVC Fire Sprinkler Systems From Connection to Anti-Bacterial Corrosion Lined Metal Piping

Flameguard Jobsite Notice

FlameGuard Turnover Notice

http://www.harvelblazemaster.com/caution_areas/chemical_compatibility.asp
http://www.harvelsprinklerpipe.com/caution_areas/pdf/chemical_compatibility.pdf
http://www.spearsmfg.com/flameguard/FGW-A-0408_0408_web.pdf
http://www.spearsmfg.com/flameguard/FGW-B-0408_0408_web.pdf
http://www.spearsmfg.com/flameguard/FlameGuard%20Jobsite%20Notice.pdf
http://www.spearsmfg.com/flameguard/FlameGuard%20CPVC%20Fire%20Sprinkler%20Turnover%20Document.pdf

C. Design wet pipe sprinkler systems, unless installed in areas subject to freezing. Dry pendant or sidewall sprinklers, dry pipe, or antifreeze systems may be used in areas subject to freezing. Propylene glycol shall be used if antifreeze systems need to be installed. Do not use pre-action type systems.

Note: NFPA 25 requires dry sprinklers to be removed and tested every 10 years due to the extremely high failure rates of these types of sprinklers. They are not recommended.

D. Sprinkler systems shall be hydraulically calculated by any design approach allowed by NFPA 13, except that the Special Design Approach shall not be used in Health Care. Pipe schedule systems may be used for extension of existing pipe schedule systems where water supply is adequate. Sprinkler systems shall be designed based on available water supply without the fire pump operating, where possible. A safety factor shall be included by calculating the demand to a point no greater than 10% below the available water supply curve. Or, a ten percent safety factor shall be provided (subtract 10% from the available water supply curve) for each sprinkler demand including the required hose streams.

E. Sprinkler densities shall comply with NFPA 13, except in rooms containing movable/mobile shelving (high density storage) where the density shall be Ordinary Hazard (Group 2).

F. Delineate on the drawings special conditions such as storage racks/shelving location, height and configuration (including mobile shelving); atria; open ceilings, or architecturally sensitive areas; audiometric booths; walk-in freezers and cold rooms; computer rooms and raised flooring; loading docks and exterior canopies; residential sleeping etc. which may have an impact on sprinkler design and installation.

G. Coordinate with the facility and show smoke zone boundaries, hazard classification, density, and other special requirements on drawings. Sprinkler zones shall coincide with all smoke zone boundaries within health care occupancies.

Note: Since the sprinkler contractor is required by NFPA 13 to hydraulically calculate the system and provide working drawings, this effort should not be duplicated by the A/E. Some items commonly not identified on the drawings that create problems are drain terminations, hazard classification, smoke zone boundaries, and water supply hydraulic information. The contractor needs to know where to start, what water supply is available, the commodities being protected, what area is supplied by each flow switch, and special circumstances such as areas subject to freezing and combustible concealed spaces.

H. Rooms containing bulk supply storage shall be classified as required by NFPA 13. If provided by the contract, storage racks shall utilize open shelving systems. Ensure shelving which obstructs sprinkler water from penetrating down through racks is not used.

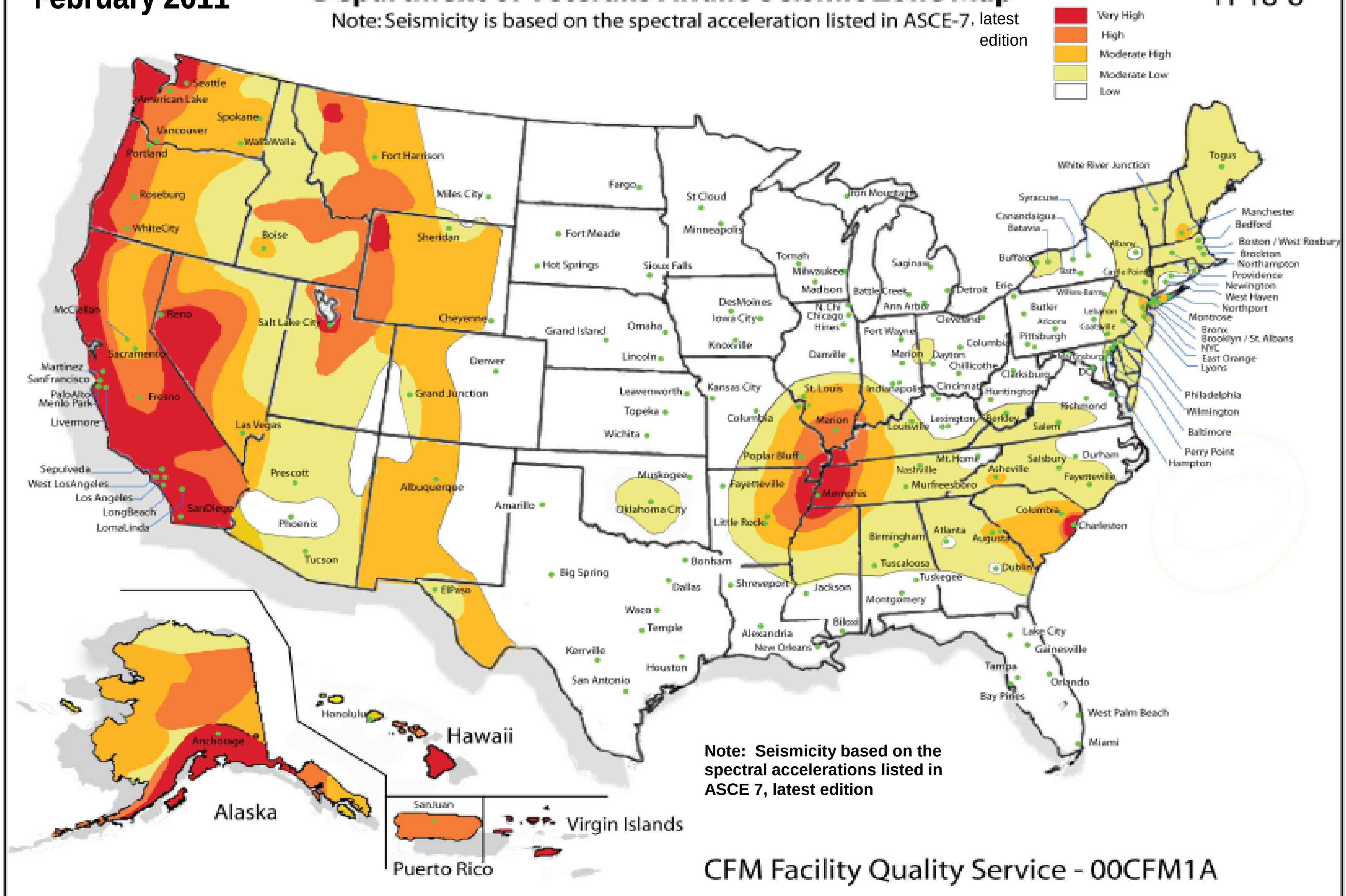
I. Provide seismic protection when the building is in an area of Moderate High, High, or Very High seismicity as identified in the map below taken from VA Seismic Design Requirements H-18-8. (Refer to H-18-8 for updated requirements. See http://www.cfm.va.gov/til/etc/seismicmap.pdf for latest version.)

February 2011

Department of Veterans Affairs Seismic Zone Map

Note: Seismicity is based on the spectral acceleration listed in ASCE-7, latest edition

H-18-8



Note: Seismicity based on the spectral accelerations listed in ASCE 7, latest edition

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J. Install quick response sprinklers (QRS) in all areas, except where specifically prohibited or noted elsewhere in this document. (e.g., in areas requiring high temperature heads where no quick response sprinklers are listed, data centers, electrical switchgear rooms, elevator shafts, or elevator machine rooms) On retrofit projects, replace existing standard response sprinklers with QRS within the smoke compartments being modified.

Note: It is permissible on a case by case basis to install standard response sprinklers in spaces within smoke zones that are protected by quick response sprinklers, such as in a main electrical switch gear room or a data center. (It is generally not permissible to mix standard and quick response sprinkler heads within a room or corridor). The risk of an accidental discharge due to physical damage of the sprinkler is lessened with the installation of standard response sprinklers since they generally have an operating element that is more massive than the operating element of quick response heads. The advantage gained in response time by installing quick response sprinklers would not be worth the increased risk to the electrical equipment and personnel due to possible accidental discharge of a QR sprinkler. (It is easier to break a quick response glass bulb head by striking it from the side than it is to break a standard response glass bulb head).

K. Sprinklers to be installed in VA facilities are required to be Factory Mutual (FM) approved as quick response except as identified below. At the present time, concealed sprinklers are not permitted to be used for new construction in VA facilities because there are none that have passed the FM test for quick response (see Exceptions 2 and 3). On retrofit projects, replace existing standard response sprinklers with QRS within the smoke compartments being modified.

Exception 1. “Institutional” type sprinklers in accordance with Paragraph (L) below.

Exception 2. Concealed sprinklers that are UL Listed quick response and FM approved standard response are permitted in clean rooms (e.g., USP 797 designed rooms) provided that the rooms are not designed under negative pressure (e.g. USP 797 rooms for hazardous drugs are required to be under negative pressure).

Note: Factory Mutual test requirements are different than Underwriters Laboratories Inc. (UL) test requirements. One example of this is the test for quick response concealed sprinklers. At the present time, there are no concealed sprinklers that have passed the FM test for quick response. Even those that are UL listed quick response concealed sprinklers have not passed the FM quick response test.

Note: The VA recognizes the need for concealed sprinklers where the surfaces of the rooms have to be cleanable. However, concealed heads are not permitted by the manufacturers to be used in a negative pressure room.

Exception 3. In special instances, concealed sprinklers that are UL Listed quick response and FM approved standard response may be used with the approval of the VHA Central Office Fire Protection Engineer or the CEOSH Fire Protection Engineer.

Note: Examples of special instances where non-FM approved concealed sprinklers might be appropriate include closets or audiometric booths with low ceilings.

Exception 4: FM Approved standard response sprinklers shall be permitted where quick response sprinklers are prohibited. (e.g., elevator shafts or elevator machine rooms) and as noted below.

Note: It is permissible on a case by case basis to install standard response sprinklers in spaces within smoke zones that are protected by quick response sprinklers, such as in a main electrical switch gear room. (It is generally not permissible to mix standard and quick response sprinkler heads within a room or corridor). The risk of an accidental discharge due to physical damage of the sprinkler is lessened with the installation of standard response sprinklers since they generally have an operating element that is more massive than the operating element of quick response heads. The advantage gained in response time by installing quick response sprinklers would not be worth the increased risk to the electrical equipment and personnel due to possible accidental discharge of a QR sprinkler. (It is easier to break a quick response glass bulb head by striking it from the side than it is to break a standard response glass bulb head).

L. Install UL listed or FM approved “institutional” type quick response sprinklers in psychiatric areas where sheet rock or plaster ceilings are required by PG-18-14, Room Finishes, Door and Hardware Schedule. Installation of “institutional” sprinklers in psychiatric areas with lay-in acoustical tile ceilings may be appropriate where constant supervision by staff is not provided. Consult facility for locations and for additional requirements. Show these areas on drawings.

Note: For additional requirements concerning mental health facilities, consult with the facility patient safety manager or suicide prevention coordinator and obtain a copy of the VHA Mental Health Environment of Care Checklist (MHEOCC). Note: The issue of where to place “institutional” sprinkler heads should be taken to the facility safety committee/patient safety/risk management group. Staff supervision of the patients, other institutional building features, and clinical diagnoses will all play a part in whether “institutional” type sprinklers are required.

There are no standardized tests that are used to qualify a sprinkler as an “institutional” type sprinkler. “Institutional” is a marketing term used by the manufacturers of the sprinklers. At the present time, there are no FM approved sprinklers that are marketed as “institutional” type. At the time of design, it is recommended that the market be surveyed and that the sprinkler model with the most favorable characteristics be specified.

The following features are typically characteristic of an “institutional” sprinkler:

- *Tamper resistant construction including a tamper-resistant escutcheon to reduce the possibility of the escutcheon being removed and used as a weapon.*
- *Components designed to break away to reduce the possibility of being used as an anchor for hanging. (Tyco TFP MAX [Pendent & Sidewall] 75lbs dynamic load, Viking VK410 [Pendent] 30lbs at 6 inches, Viking VK412 [Sidewall] 40lbs at 6 inches, Reliable XL INST [Pendent and Sidewall] 50lbs at 1 inch). {Information above is for quick response institutional sprinklers as of 4/02/2007}.*

Note: While institutional fire sprinklers may be designed to break at pre-determined static or dynamic loads, it is possible for compression of the jugular or carotid arteries to occur with as little as 4 pounds causing death. Therefore it is very important that fire sprinklers and their appurtenances not provide any element that could serve as an anchor point for a lanyard or ligature.

- *Installation instructions and sprinkler components designed to reduce the possibility of the escutcheon being used as an anchor for hanging. One design approach involves a retaining collar that is attached to the sprinkler pipe with set screws. This design is intended to prevent the escutcheon from being pulled away from the ceiling surface. This design would not be appropriate where the ceiling surface is a lay-in ceiling. A lay-in ceiling allows access to numerous anchor points by the removal of or punching through a tile. Another design approach involves an escutcheon installed with spacers. This design is also intended to prevent the escutcheon from being pulled away from the ceiling surface. This approach may be compromised if there is deflection in the sprinkler piping such that the escutcheon can be pulled away from the ceiling surface. If this approach is to be used, plastic pipe should not be permitted (plastic pipe is not permitted for new VA facilities) and a hanger should be installed at each sprinkler drop to prevent pipe deflection.*

M. Install standard response sprinklers with intermediate temperature rating 93°C (200°F) or higher in elevator shafts, elevator pits, and elevator machine rooms. Install sprinklers in elevator shafts and pits only where required by NFPA 13. (Note: See Section 7 for necessary power shutdown requirements.)

N. Do not use flow control (on/off) sprinklers.

O. Where buildings are required to be sub-divided into smoke compartments, segregate sprinklers into zones that correspond to the smoke compartments. Coordinate sprinkler zones with smoke (compartments) and fire alarm evacuation zones. Provide a flow switch, isolation valve, tamper switch, and pressure gage for each zone. Provide separate zones for paint spray booths, dust collectors, and lint collectors.

P. Route the drain pipes for each sprinkler riser and test connection to the building exterior to facilitate testing. Do not terminate at service sinks as their drains are inadequate for test flow. Drain piping shall be 50 mm (2 in) minimum to accommodate discharge from full flow tests at maximum system pressure. Design exterior drains to prevent flooding or damage to landscaping, and to prevent wetting of walkways.

Q. Specify non-ferrous piping for all areas within Magnetic Resonance Imaging (MRI) suites.

R. Determine and identify on drawings the location of fire pump, risers, all valves, fire department connections, drains, and points of connection with underground fire service main.

6.2 Standpipes and Fire Hose Connections:

A. Standpipes shall be installed in all buildings where required by NFPA 101, NFPA 45, or NFPA 1, except as modified by the following paragraphs.

B. Install Class I hose connections per NFPA 14.

C. Wet standpipes are preferred.

D. Flow and pressure requirements shall comply with NFPA 14 except as modified in Section 5.3, Fire Pumps.

Note: If the facility is a high-rise building, defined by NFPA 14 as a building more than 75 feet from the lowest level of fire department access to the floor of the highest occupied level, an automatic standpipe system is required by NFPA 14. It is the position of the VA that the building fire pump be sized only for the sprinkler system demand and to let the fire department supply the flow and pressure for manual fire fighting. The fire pump should be sized to handle the automatic standpipe fire fighting requirements in NFPA 14 only where the fire department pumper truck cannot provide the necessary pressure, and this is not anticipated at any VA facility. The designer must verify that the fire department can adequately supply the manual fire fighting requirements.

E. For seismic requirements, refer to Section 6.1.I.

6.3 Gaseous Systems (Clean Agent, Carbon Dioxide, etc.): Reserved.

6.4 Portable Fire Extinguishers:

A. Do not provide fire extinguishers. Locate fire extinguisher cabinets to comply with NFPA 10. Locate additional fire extinguisher cabinets in the surgical suite, high value IT (Information Technology) equipment and telephone switch rooms, and in elevator machine rooms.

B. Size fire extinguisher cabinets to accommodate a 9.5 L (2-1/2 gallon) pressurized water extinguisher. Recessed cabinets are preferred. Specify conspicuous marking of recessed cabinets.

6.5 Extinguishing Systems for cooking facilities/equipment: Provide wet chemical fire extinguishing systems in accordance with UL 300 and NFPA 17A. See Section 3.3. Dry chemical systems shall not be installed.

7. FIRE ALARM SYSTEMS Fire alarm systems shall be installed in buildings when required by this section.

7.1 Purpose:

A. The primary purpose of a fire alarm system is to notify the appropriate people and initiate the proper response from those people who are notified.

B. The secondary purpose is to initiate fire safety functions, which are building and fire control functions that are intended to increase the level of safety for occupants or to control the spread of the harmful effects of fire.

C. The fire alarm system operation must be coordinated with the facility fire plan.

Note: This does not preclude the fire plan from being modified to meet the fire alarm system operation.

7.2 General Requirements:

A. The fire alarm system shall be installed where required by NFPA 101 and shall be designed to meet the requirements contained in NFPA 72, National Fire Alarm Code, and this manual.

B. For the purposes of this manual, VA facilities will fall into one of the following three categories:

Note: The proper categorization of a building or an area of a building will help to identify the type of notification required as well as the correct placement of notification appliances as indicated later in this section.

1. Health Care (excluding free standing Ambulatory Health Care)
2. High Rise, non-Health Care
3. Other, including free standing Ambulatory Health Care

C. Do not combine fire alarm systems with other systems such as building automation, energy management, security, etc. Down time for any of these non-life safety systems will also take the fire alarm system out of service. This is not acceptable to the VA.

D. All fire alarm wiring shall be installed in raceway separate from all other systems.

E. Wiring installed in metal raceway within buildings that are protected throughout by sprinklers shall be considered to meet the requirements for Pathway Survivability Level 2 in accordance with NFPA 72(2010) as a 2-hour performance alternative that has been approved by the authority having jurisdiction and shall be permitted for voice communication systems in VA facilities.

F. Wiring for local building fire alarm systems shall be specified as defined in NFPA 72 as follows:

Initiating Device Circuits (IDC): Class B.

Signaling Line Circuits (SLC): Class B.

Notification Appliance Circuits (NAC): Class B.

Communications between building fire alarm control units: Class X.

Note: Class B signaling line circuits (these are not initiating device circuits by definition) are preferable for local building fire alarm systems because it permits the circuits to be t-tapped and the allowable length of the circuits are not shortened. No clear advantage is seen for running Class A circuits except where signaling line circuits are run between building fire alarm control units. Where signaling line circuits are run between fire alarm control units in separate buildings, fiber optic circuits are preferred because they are not susceptible to damage from lightning strikes. Where Class X copper circuits are installed, provide isolation modules that will ensure that only one building is lost (will not respond) during any type of fault. Although desirable, it is not required that Class X circuits be run in separate conduits from each other.

G. Analog addressable systems are encouraged where many smoke detectors are required to be installed. These systems do not require the frequent sensitivity testing for smoke detectors that the hard-wired systems require and the savings in testing will pay for the extra cost of the system.

H. Fire alarm design shall include a single line riser diagram that denotes location and device type.

7.3 Typical Operation:

A. Table 7.3 is provided to identify the typical operation required by the respective fire alarm systems. A table similar to this should be added to the contract documents to indicate the specific operation required of the system.

TABLE 7.3 Fire Alarm System Input Output Matrix

INPUT DEVICE ↓ / OUTPUT →	1.Sound general building alarm for Other and High Rise (non-Health Care). See Section 7.2.1	2. Notify necessary staff for response for Health Care and High Rise buildings only (alarm signal may be different on different floors).	3. Notify Fire Department.	4. Initiate supervisory signal to a 24-hour manned point for immediate response.	5. Close associate smoke barrier doors on the floor.	6. Close dampers on fan proximate to detector.	7. Shut down air handler served by the detector.	8. Recall elevator.	9. Initiate elevator shut down and disconnect elevator power.	10. Open **locked egress doors on floor of fire origin.	11. Disconnect fuel source from cooking equipment.
Duct Smoke Detector*				X		X	X[a]				
Area Smoke Detector*	X	X	X							X	
Door Release Smoke Detector*	X	X	X		X	X				X	
Elevator Smoke Detector*	X	X	X					X			
Manual Pull Station	X	X	X		X					X	
Elevator Machine Room Heat Detector	X	X	X						X		
Generator Room Heat Detector	X	X	X							X	
Sprinkler Waterflow / Pressure Switch	X	X	X		X					X	
Water Control Valve Tamper				X							
Fire Pump (Any alarm condition required by NFPA 20)				X							
High/Low Pressure Dry-Pipe Sprinkler System				X							
Kitchen Hood Suppression System	X	X	X		X					X	X
Gas Extinguishing Systems	X	X	X		X					X	
Dry-Pipe Valve Room Temperature Alarm				X							
Dedicated Fire Water Storage Tank Low Level				X							
Dedicated Fire Water Storage Tank Low Temperature				X							

*While NFPA 101 does not require some detectors to notify building occupants, VA requires all smoke detectors, other than duct smoke detectors, to notify building occupants. Only install smoke detectors when required by the Life Safety Code or its references.

** Those doors that are required to be tied to the fire alarm system such as delayed egress and access controlled doors.

a – Do not provide duct detectors in dedicated (100%) exhaust fans, they should continue to run.

B. Notification of staff for response shall be by digital voice (speaker) systems unless not warranted by existing conditions (e.g., small extensions to an existing coded system). For new systems, do not use coded or taped voice systems. Where speakers are installed as the notification appliance, the fire alarm system shall be designed such that it is possible to manually broadcast an emergency voice message simultaneously to all buildings provided with speakers. Selectable switches shall also be provided at the fire alarm voice control panel so that a manual voice message can be communicated to each connected building individually. As a minimum, provide one switch per building. Additional switches (e.g., one switch per floor or zone) are optional.

C. Coordinate fire alarm zones with smoke compartments and sprinkler zones (See Section 6.1.N).

D. Provide initiating devices in accordance with NFPA 101, NFPA 72, and provide additional manual pull stations adjacent to the nurse's stations in health care occupancies.

E. Provide institutional style (key to operate or locking covers) pull stations in psychiatric areas. Provide covers on pull stations in child care centers to prevent children from initiating unwanted alarms. Coordinate with the facility.

F. Notification Appliances: Placement and spacing of notification appliances shall be in accordance with NFPA 72 and shall be selected based on the purpose of the notification (i.e., general evacuation or staff response) as follows:

1. **General Evacuation** (See output 1 of Table 7.3): Where general evacuation is required, the audible signal shall conform to ANSI S3.41, Audible Emergency Evacuation Signal (i.e., temporal three pattern).

Note: These requirements are based on the building or area of the building being evacuated upon alarm. Many areas in a health care setting should be designed as general evacuation areas since there will be few or no trained staff to direct traffic. For example, cafeterias, basements, and administration sections could be considered to be general evacuation areas. For small stand-alone buildings, systems using bells or horns should be provided unless communication from the main hospital building using a voice system is desired. See the discussion under Section 7.3.F.2, Staff Response.

a. Provide audible notification appliances to be heard in all locations throughout the protected premises (building).

b. Provide visible notification appliances in all public accessible areas of the building such as corridors, auditoriums, cafeterias, open assembly rooms >= 750 ft^2, canteens, retail stores, etc. Exception: Visible notification appliances are not required in the following spaces which are not considered to be public accessible:

1) Individual office spaces unless the space is known to have a hearing impaired person stationed there.

2) Closets (janitor's, clothes, etc.)

3) Utility shafts.

4) Crawl spaces.

5) Normally unoccupied rooms <= 100 ft^2.

6) Normally unoccupied storage spaces where no regular activities take place other than placement and retrieval of storage.

7) Stairway enclosures and elevators.

8) Patient exam/treatment rooms.

Note: Though the U. S. Access Board has rendered an opinion that requires strobes in examination and treatment rooms, the VA modifies this recommendation and does not require strobes in examination and treatment rooms since patients will only be in these rooms with permission of the staff. This is in line with the last paragraph of Technical Bulletin # 2 enclosed (included at end of this document).

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2. **Staff response** (See output 2 of Table 7.3):

Note: These requirements are intended for the defend-in-place requirements of the health care occupancy where staff need to know what is happening so they can give direction to those who need it. Patients are considered to be in need of help for evacuation and evacuation itself will only be undertaken as a last effort.

***Fire Alarm System Operation for Health Care Occupancies - Background**:*

What is required? How does VA meet the requirements? Why do it this way? Other Issues, General Requirements.

What is required?

The Life Safety Code states, "For health care occupancies, the proper protection of patients shall require the prompt and effective response of health care personnel." It goes on to say, "The basic response required of staff shall include the following:

(1) Removal of all occupants directly involved with the fire emergency

(2) Transmission of an appropriate fire alarm signal to warn other building occupants and summon staff

(3) Confinement of the effects of the fire by closing doors to isolate the fire area

(4) Relocation of patients as detailed in the health care occupancy's fire safety plan."

The fire alarm system in a health care occupancy should immediately notify the staff in the zone of alarm origin to take action (e.g., "RACE") and simultaneously summon adequate staff remote from the zone of alarm origin to respond to assist staff in the zone of alarm origin.

How does VA meet the requirements?

The VA takes the following approach for implementing the requirements of the code for health care facilities:

a. Upon operation of a fire alarm initiating device, the fire alarm system will, **<u>in the zone of alarm origin only</u>**,

   1. Notify staff/occupants by activating a temporal three alarm signal and

   2. Activate the visible appliances (strobes).

b. Simultaneously the fire alarm system will send a voice message to the rest of the building and other buildings as necessary to notify enough staff to respond to the zone of alarm origin. No visible appliances will be activated outside of the zone of alarm origin.

Note: For Health Care Occupancies, an adequate number, as a minimum, is considered to be one staff member for each two nonambulatory patients within a smoke zone in buildings that are not fully sprinklered, and one staff member for each four nonambulatory patients for fully sprinklered buildings. Nonambulatory patients are considered to be those who are incapable of taking action for self-preservation under emergency conditions without assistance from others. Nonambulatory patients include behaviorally impaired patients. For further guidance, see VHA Directive 2005-037, Planning for Fire Response.

c. Subsequent activations of initiating devices in the same zone of alarm origin will not initiate any new alarm outputs, but will appear at the fire alarm control unit and printer. Subsequent to the original alarm, activation of initiating devices in a different zone will initiate the temporal three signal and visible appliances in the new zone and will initiate a new voice message to the locations as determined above, to identify the new location of alarm.

Note: It is anticipated that personnel will respond and take control of the system before too many initiating devices are activated.

d. The temporal three signal is to be designed to the private operating mode requirements contained in NFPA 72.

Note: This should be interpreted to mean that the sound pressure level is not so loud that staff cannot communicate during the alarm, but loud enough to hear that an alarm is sounded in the zone. The speakers do not have to meet the sound pressure levels for public operating mode identified in NFPA 72. There may be some parts of the building where the speakers would be tapped to meet the public mode sound pressure levels where the intent is to have occupants evacuate in that section of the building. Occupant notification requirements should be carefully reviewed during the design, taking into account the training (or lack of training) of staff and activities that are expected to take place in the space.

Clinic spaces can often be addressed the same as in-patient ward spaces since staff will have the same level of fire safety training and the clinic operations are very similar to that which would be found in a typical in-patient ward with the exception that the hours of operation may be only during normal business hours.

Attached warehouses, shops, and mechanical penthouses are areas where the sound pressure levels may need to be designed for public operating mode, especially if routine events occur during which there are no trained staff to respond and direct occupants.

e. The strobes are to be installed as outlined below and synchronized if necessary within the zone in accordance with NFPA 72. Both audible and visible signals are to be programmed to continue to operate for five minutes or until the system is acknowledged and turned off/silenced by an operator. The strobes are only to be activated in the zone of alarm origin and not in the zones where the voice message is used.

Note: This will allow staff to be trained to take action as if the fire is in their zone when they see the strobes or hear the temporal three signal.

Generally, the voice message is sent only to the remainder of the building in which the alarm occurs. However, in some cases, the message must be sent to additional buildings to summon sufficient numbers of staff to help relocate patients.

f. The voice message is to be preceded by a tone alert. No less than three rounds of a voice message to bring staff to the zone of alarm origin is required to be announced.

For Example: (tone alert) "Code Red, First Floor Center, Code Red, First Floor Center, Code Red, First Floor Center." The message content is to be coordinated with the local VA Medical Center Staff.

g. Manual operation of the voice system will override all automatic voice messages in the system.

Why do it this way?

The operation provided above will elicit a more rapid response from staff in the zone of alarm origin since this is the only location where visible strobes and the temporal three signal are activated. The strobes and temporal three signals require no interpretation and staff can immediately respond. In older coded systems and in voice systems, the occupants/staff must take time to interpret what the code is or what the voice message says before carrying out their defined duties in a fire event.

Since most health care buildings in the VA are actually mixed occupancies, the arrangement above works well for those buildings that contain mixed occupancies. If the alarm originates in an area (this could be an entire floor) of a health care building that is a business occupancy or equivalent, the alarm system would generate a temporal three signal and activate the visible appliances throughout the area. This would be the proper signal for untrained occupants to evacuate. If there are staff in the area, they will be trained to take appropriate action for the signal received.

Other Issues

h. To help ensure that the alarm is initiated in the zone of alarm origin, smoke detectors that are installed to hold open smoke barrier doors at smoke zone barriers shall be installed on both sides even though NFPA 72 allows, in some cases, a detector to be installed on one side only. Detectors shall then be programmed for their respective zone to initiate the proper alarm as well as to close the door served.

Note: It should be noted, and it is recognized, that there is always a possibility that the smoke from a fire would set off a detector in an adjacent zone first, or a staff member may activate a manual box in an adjacent zone.

There are other systems that can be utilized to help summon staff during a fire alarm activation. These include paging and radio systems. In some instances it may be beneficial to tie the fire alarm system outputs to summon staff by way of these systems.

i. While fire alarm voice communication systems are not permitted to be used as general paging systems, they may be used for emergency communications other than fire emergencies where the operators are trained in the use of the system.

General Requirements

j. Provide speakers to be heard in all locations throughout the protected premises from where staff must respond. This may include more than one building if the number of staff within a building is not adequate. For health care, nursing ward areas should be utilized for responders since areas other than nursing wards (e.g., administration areas) will generally be occupied only during normal business hours.

k. Speakers shall be installed and arranged so they are clearly heard and understood by staff under normal working conditions. A rule of thumb for speaker layout is to install them every twenty-five to thirty feet on center and not to expect them to be clearly heard through more than one wall.

Note: The SFPE Handbook of Fire Protection Engineering provides guidance on the placement of audible notification appliances.

1) Do not locate audible notification appliances within surgical operating rooms. However, ensure that the temporal three signal can be heard within all surgical operating rooms.

2) Provide subdued audible notification appliances in critical care areas.

l. Provide visible notification appliances in the following areas:

Note: Strobes are activated only in the zone of alarm origin. Strobes in areas outside of the zone of alarm origin provide no help to staff to identify the location to which they are to respond. Strobes are to be located to assist staff to react immediately without having to interpret the signal. That is, if staff see that the strobes are activated then staff know that they are within the zone of alarm origin.

1) Spaces subject to noise, such as mechanical equipment rooms, where the message delivered by the audible appliance might not be heard or might be unintelligible.

2) Audiometric booths (not required if the light from the appliance can be seen from within the booth.)

3) Public restrooms.

4) Public accessible areas of the building such as corridors, auditoriums, cafeterias, open assembly rooms >= 750 ft^2, canteens, retail stores, etc. Exception: Visible notification appliances are not required in the following spaces which are not considered to be public accessible:

    a) Individual office spaces unless the space is known to have a hearing impaired person stationed there.

    b) Closets (janitor's, clothes, etc.)

    c) Utility shafts.

    d) Crawl spaces.

    e) Normally unoccupied rooms <= 100 ft^2.

    f) Normally unoccupied storage spaces where no regular activities take place other than placement and retrieval of storage.

    g) Stairway enclosures and elevators.

    h) Patient exam/treatment rooms.

Note: Though the U. S. Access Board has rendered an opinion that requires strobes in examination and treatment rooms, the VA modifies this recommendation and does not require strobes in examination and treatment rooms since patients will only be in these rooms with permission of the staff. This is in line with the last paragraph of Technical Bulletin # 2 enclosed (included at end of this document).

http://www.cfm.va.gov/til/dManual/ADAAGBull2VisualAlarms.pdf

5) Do not provide visible notification appliances inside critical care areas, surgical operating rooms, or patient sleeping rooms.

6) Do not provide visible notification appliances in any health care occupancy where their presence would interfere with patient treatment (such as psychiatric areas). Consult with the facility.

G. Flash rate shall not exceed one flash per second (1 Hz) for visible appliances. Strobes that operate on adjacent zones on each floor shall be synchronized with one another as required by NFPA 72.

H. Provide fire department notification by any of the allowed methods identified in NFPA 72. Where direct connections to the fire department are permitted by the fire department, they shall be acceptable as long as the circuit is supervised for grounds, shorts, and opens.

Note: The four types of connections identified in the Life Safety Code are auxiliary, central station, proprietary, or remote station. When there is a VA fire department on site that receives the signal, it is generally considered to be a proprietary system. The typical VA loop system is connected to the fire department via an auxiliary connection (masterbox) or a positive non-interfering and succession (PNIS) module in the control panel. A proprietary system requires the VA fire department or other VA forces to respond to all signals, alarm, supervisory, and trouble. Some may have a direct connection to a non-VA fire department, but these connections are not normally installed in accordance with any requirements contained NFPA 72. Central station has its own niche and that is for highly protected risk (HPR) facilities. The VA, in most instances, connects via a Digital Alarm Communication Transmitter (DACT) to a listed central station for monitoring purposes only. This is a remote station service as defined in the code. A telephone operator's phone call to the fire department is not sufficient (however, per VA policy, a phone call from the telephone operator is required in addition to one of the four types of connections).

I. All building fire alarm systems having outputs in column 2 of Table 7.3 shall be designed, at a minimum, to be capable of performing the output functions specified in columns 1, and 4 through 11 when communications outside of the building are lost.

Note: As a minimum, buildings will stand alone as a general evacuation alarm system when communications are lost to other networked buildings. Some designs require a signal from a remote building to operate properly. Where that communication is lost, the building should default as indicated to provide a general evacuation signal.

J. Fire fighter telephones: Where required by the Life Safety Code and where hand-held radios are ineffective for communication by emergency personnel within a building, two-way telephone communication service shall be provided in accordance with the Life Safety Code and National Fire Alarm Code. A telephone jack shall be provided at the fire pump in addition to the telephone jack locations identified in the codes.

7.4 Special Requirements

A. Locate the main fire alarm panel at the front entrance or at a 24-hour location coordinated with the facility. This will allow the fire department to utilize the panel as an annunciator where no occupants are present.

Note: Care should be taken when determining which locations are staffed on a 24-hour basis. For example, locations such as the VA Police office or VA Fire Department station house might not be staffed continually.

B. Provide space for fire alarm terminal cabinets (if required) and conduit risers.

C. In accordance with NFPA 72 and 101, provide smoke alarms in domiciliary resident sleeping rooms, family/staff quarters, on-call staff sleeping rooms, hoptel sleeping rooms, and other sleeping rooms in non-patient areas. ABA and ADA require a minimum of 1 unit, and 1 out of each 25 rooms in each occupancy category, to be provided with visible appliances (strobe lights) activated by the smoke alarm. Facilities are encouraged to provide additional visible notification appliances (combination smoke detector/visible notification appliance) up to 100%, where possible. See NFPA 72 for light intensity and mounting instructions.

Note: If visible notification appliances are provided in only 1 in 25 rooms, the facility will have to ensure that hearing-impaired persons are assigned only to those rooms where accommodation (visible notification) is provided. Installing strobes in all rooms will allow a hearing- impaired person to occupy any room. In addition, for every room which contains a strobe light activated by a smoke alarm and where a building fire alarm system is present, the room must also contain a strobe light activated by the building fire alarm system.

D. Smoke detectors are to be installed only where required by the National Fire Codes, this design manual, or where required by an equivalency. All smoke detectors shall be photoelectric type only. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning. Nurses stations that are not staffed 24/7 are considered spaces that are open to the corridor and might require smoke detection in accordance with NFPA 101.

E. Heat detectors are not required unless used in conjunction with elevator shutdown, where used as a substitute for smoke detectors in environments unsuitable for smoke detectors, or where used to protect emergency generators that are not equipped with automatic sprinklers. Exception: Heat detectors are not required in small remote buildings that house emergency generators. Provide heat detectors in all generator rooms in non-sprinklered buildings. The heat detector shall be fixed temperature, extra high temperature (325-375 °F) rating. It is anticipated that most generator rooms will be sprinkler protected and will not require heat detectors.

F. Indicate the capacity of all air-handling units. Duct smoke detectors are to be installed only where required by NFPA 101 or NFPA 90A. Where duct a smoke detector is located above a ceiling or in a difficult to reach location, provide a remote indicating lamp and a test key switch on nearby wall at 7 ft AFF to facilitate testing.

G. When an annunciator is required, it shall be located at the building entrances where the fire fighters will respond. The main control panel can act as an annunciator. Coordinate the location with the local fire department. Circuits from the fire alarm control panel to a remote annunciator shall be supervised.

H. Elevators: Elevator fire protection shall comply with the requirements of NFPA 13, NFPA 70, NFPA 72, and ANSI/ASME A17.1 or A17.3 as applicable.

Note: Designers are reminded of the requirement in Chapter 7 of NFPA 101 for independent ventilation or air conditioning systems to maintain proper temperature during elevator fire fighters service operation for elevator machine rooms that contain solid-state equipment for elevators having a travel distance of more than 50 feet above the level of exit discharge or more than 30 feet below the level of exit discharge, and the requirement that when standby power is connected to the elevator, the machine room ventilation or air conditioning shall be connected to standby power.

Note: Elevators have been an ongoing fire protection problem, not only for the VA, but also for the entire industry. Many conflicting requirements seem to exist at any given time. Although other methods are permitted in the National Fire Alarm Code for power shut down when sprinkler protection is present, the VA uses the heat detector option as identified in the National Fire Alarm Code and as clarified below.

1. Provide smoke detection for Phase I recall for new elevators. Provide smoke detection for Phase I recall for existing elevators that have a travel distance of 25 feet or more above or below the level of fire department response (this is generally a building greater than three stories).

   Note: The requirements for Phase I recall do not apply when the hoistway, or portion thereof, is not required to be fire-resistive construction, the travel does not exceed 6 ft 8 in, and the hoistway does not penetrate a floor.

   a. Provide smoke detectors in the elevator lobbies, in elevator machine rooms, and elevator machine and control spaces to initiate Phase I recall. Provide smoke detectors at the top of the elevator hoistway to initiate Phase I recall only when sprinklers are installed at the top of the hoistway.

      Note: Smoke detectors are only required above the elevator machine room equipment in larger rooms that contain other mechanical equipment. Some rooms have a lot of space that is not dedicated to elevator equipment smoke detection would not be required for that space.

   b. Provide three supervised control circuits from the fire alarm system to a point within three feet of the elevator controller for the purpose of providing an interface with the elevator system. When actuated, the three circuits will, respectively, 1) initiate recall to the alternate floor, 2) initiate recall to the designated floor, and 3) initiate flashing of the firefighter helmet symbol in the elevator car.

2. Where sprinklers are installed in elevator machine rooms or elevator hoistways, provide heat detection to remove power from the elevator prior to water discharge from these sprinklers. In non-combustible hoistways and where cars meet the flammability requirements of ASME A17.1, the sprinkler at the top of the hoistway should be omitted. Sprinklers can be omitted from elevator pits of enclosed, noncombustible shafts where there are no combustible hydraulic fluids contained in the shaft. Sprinklers, when installed in the pits, shall be sidewall type installed no more than 2 feet above the floor.

   Note: Elevator cars which were built to the requirements of the ANSI code since 1985 have a flame spread no greater than 75 and a smoke developed rating no greater than 450 (Class B, per ASTM E 84 / NFPA 255). Where the elevator cars meet these requirements, NFPA 13 allows sprinklers to be omitted from the top of the hoistway as well as from the pit as indicated. When sprinklers are omitted from the top of the hoistway, NFPA 72 does not require, nor does it permit, a smoke detector to be installed at the top of the hoistway due to the difficulty experienced with performing testing and maintenance.

a. Elevator main line power shutdown (commonly known as "shunt trip"): Power to the elevator must be removed prior to or immediately upon release of water from a sprinkler in the elevator machine room (including machine space, control room, or control space) or hoistway. Operation of a heat detector used to initiate shunt trip shall cause the shunt breaker to operate, thereby removing power from the elevator(s) within the common hoistway or controlled by equipment in a common machine room. Cars sharing the same hoistway or the same machine room shall have power removed independently from cars within other hoistways or those controlled from equipment in other machine rooms.

   Note: The industry expects that the removal of elevator power (caused by operation of the heat detector) will not trap any occupants on the elevator because sequences under Phase I operation will have already moved the car(s) to the recall level and placed the doors in the open position. Smoke detection required for Phase I initiation is provided at all of the spaces where heat detection is provided for power shut down.

b. Provide 57° C (135° F) rate compensation heat detectors within two feet of each sprinkler in the elevator machine room and hoistway in accordance with NFPA 72. Do not provide a heat detector for the pit sprinkler. Higher temperature rated heat detectors may be used where local conditions warrant; however, the heat detectors must have a lower temperature rating than the sprinklers. The sprinklers in the elevator machine rooms and hoistways must be standard response type; quick response sprinklers are prohibited in these areas.

c. Provide a supervised control circuit from the fire alarm system to a supervised relay within three feet of the shunt breaker. This signal is the input to remove the mainline power to the elevator.

d. Provide a 110-vac power source to the shunt breaker independent of the elevator controller. This power circuit shall be supervised by the fire alarm system as a supervisory signal.

   Note: The shunt breaker requires 110-vac to operate and the source must be independent of the elevator in accordance with ANSI A17.1. The intent of the code is to have to a reliable power source and not to rely on one that may be on fire. Without supervision of the 110-vac power circuit needed for the shunt breaker, the condition of the power necessary for the shunt breaker to operate during a fire is unknown. There have been instances where the breaker to the 110-vac power source for the shunt breaker has been turned off and the elevator power would not shunt upon operation of the heat detector.

3. Fire alarm system elevator interface summary: As described above, there will be five supervised control circuits from the fire alarm system that will interface with the elevator system. They are as follows (see following pictorial and the accompanying notes):

   a. Input to elevator controller for Phase I recall to the designated level from actuation of smoke detectors other than at the designated level lobby.

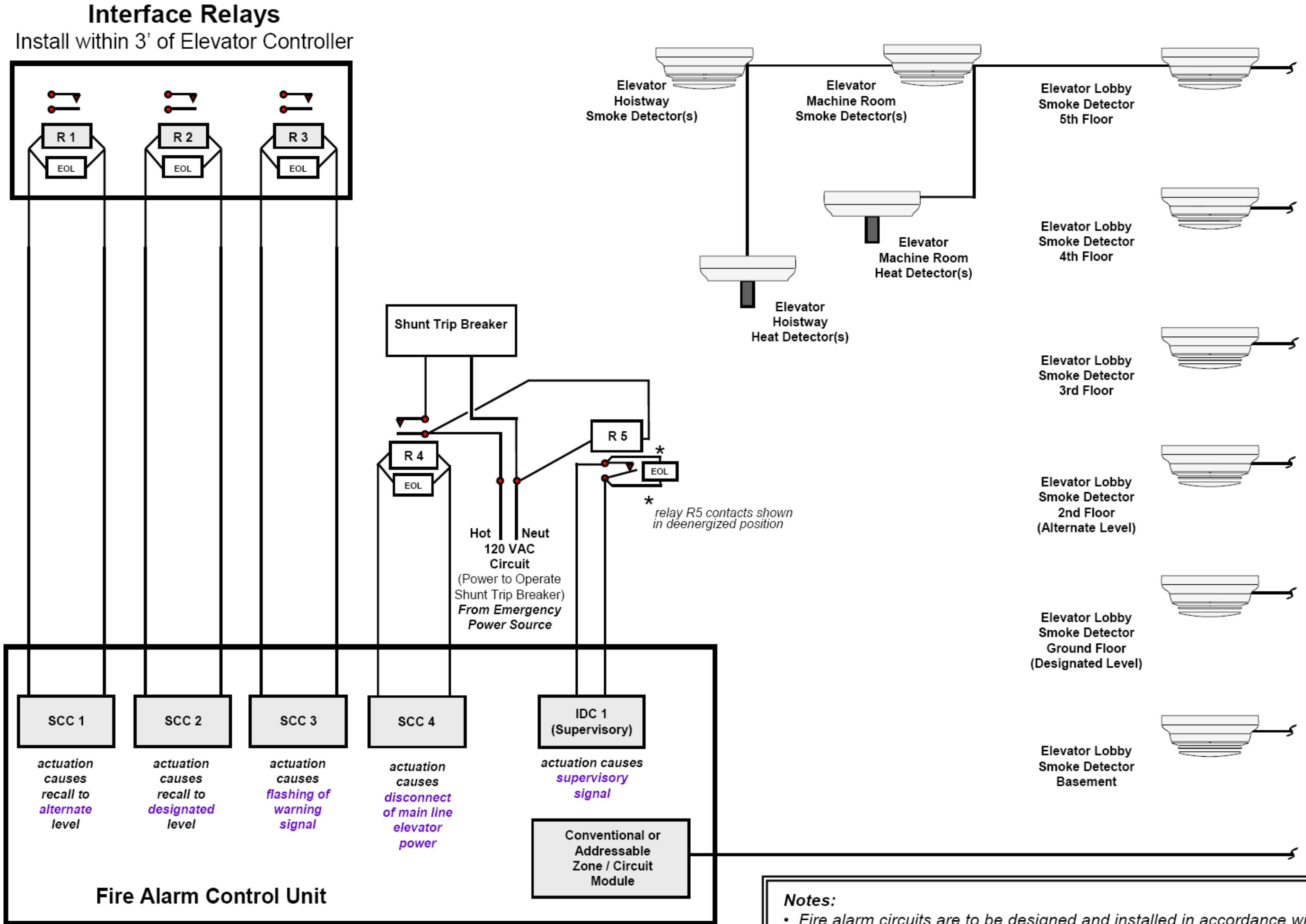
   b. Input to elevator controller for Phase I recall to the alternate level from actuation of a smoke detector at the designated level lobby.

   c. Input to elevator controller to flash the firefighter helmet signal when recall is initiated by a smoke detector in the elevator machine room or hoistway.

d. Input to elevator main line power shunt trip breaker for power shut down from actuation of heat detectors in the hoistway or machine room.

e. Supervision of the 110-vac power source to the shunt breaker.

Pictorial Representation of Fire Alarm Interface with Elevators



Notes:
- *Fire alarm circuits are to be designed and installed in accordance with NFPA 72, National Fire Alarm Code and NEC 70, National Electrical Code*
- *Refer to accompanying page which provides explanation and details of intended operation*

Explanation of Fire Alarm Interface with Elevators

Notes:

- There can be many variations of the accompanying "Pictorial Representation of Fire Alarm Interface with Elevators."
- In this example, the smoke and heat detectors are addressable initiating devices and the operating relays are "hardwired."
- To achieve supervision, the relay circuits are operated from supervised control circuits. Sometimes NACs (Notification Appliance Circuits) are used to accomplish this function.
- The supervisory initiating device that monitors the power for the shunt trip circuit is connected to a supervisory IDC (Initiating Device Circuit).
- The scenario assumes that:
  1. There is a sprinklered elevator hoistway.
  2. Means to disconnect the main line power to the elevator is via a shunt trip breaker.
  3. System operation is in accordance with NFPA 72.
  4. Relay (R5) and an IDC (Initiating Device Circuit) have been included to provide indication (via a supervisory alarm) of absence of voltage (power) to operate shunt trip breaker.

<u>Components</u> <u>Function</u>

R1 --------------- Signal to elevator controller for recall to designated level.

R2 --------------- Signal to elevator controller for recall to alternate level.

R3 --------------- Signal to elevator controller for firefighter notification.

R4 --------------- Signal to activate shunt trip relay.

R5 --------------- Supervisory relay to monitor presence of voltage (power) to operate shunt trip breaker.

SCC1 ----------- Supervised Control Circuit for operating R1.

SCC2 ----------- Supervised Control Circuit for operating R2.

SCC3 ----------- Supervised Control Circuit for operating R3.

SCC4 ----------- Supervised Control Circuit for operating R4.

IDC1------------ Initiating Device Circuit to supervise R5 contacts (monitoring power to operate shunt trip breaker).

4. Operation of the hoistway vent as required by the VA CAD Standard SD-230923-08 in PG-18-4 will be independent of the fire alarm system unless a system smoke detector is required to be installed at the top of the hoistway for elevator recall purposes as identified above.

I. Fire alarm systems shall monitor each water storage tank dedicated only for fire protection use (if applicable) for low level and low temperature and shall provide supervisory signals (monitoring is not required if the water storage tank is for combined fire protection and domestic use).

7.5 Communications between Buildings:

A. Buildings shall communicate trouble, supervisory, and alarm signals to a main 24-hour staffed location such as the telephone operator or VA police. This is in addition to VA fire department notification. Provide a printer to make a hard copy of all signals and operator responses. A backup printer is recommended at another 24-hour staffed location. Coordinate with the facility.

Note: Trouble and supervisory signals will be handled at the 24-hour staffed location. The facility will have to institute a system to handle supervisory signals immediately as required by the National Fire Alarm Code.

B. Where staff response to carry out the fire plan is required from more than one building, provide notification to other buildings. Coordinate with the facility.

------END------

APPENDIX A

Abbreviations Used in this Design Manual

ABA	Architectural Barriers Act
ADA	American with Disabilities Act
AFF	Above Finished Floor
AGV	Automatic Guided Vehicle
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
A/E	Architect/Engineer
C	Celsius
CT	Computerized Tomography or CATSCAN
cu	cubic
F	Fahrenheit
FACSUL	Fire Alarm Certificate Service
FM	Factory Mutual
FMERC	Factory Mutual Engineering and Research Corporation
ft	feet
gpm	gallons per minute
HITF	Healthcare Interpretations Task Force
HVAC	Heating Ventilating and Air Conditioning
HVD	Hoistway Vent Damper
Hz	Hertz (cycle per second)
IBC	International Building Code
in	inch
kPa	Kilopascals
kVA	Kilovolt Amps
L	liters
L/m	liters per minute
L/s	liters per second
m	meter
mm	millimeter
MRI	Magnetic Resonance Imaging
NBSIR	National Bureau of Standards Information Report

NFPA	National Fire Protection Association
NFC	National Fire Codes
PG	Program Guides
psi	Pounds Per Square Inch
PL	Public Law
QRS	Quick Response Sprinklers
SFPE	Safety and Fire Protection Engineer
sq	square
UL	Underwriters Laboratories
VA	Department of Veterans Affairs
VAC	Volts Alternating Current
VAHBS	VA Hospital Building System
VAMCS	VA Master Construction Specifications

APPENDIX B

Mandatory References

ANSI / ASME A17.1	Safety Code for Elevators and Escalators
ANSI / ASME A17.3	Safety Code for Existing Elevators and Escalators
FM Approval Manual	
NBSIR 85-3158	Fire Performance of Interstitial Space Construction System (May 1985)
NISTIR 5560	Fire Performance of an Interstitial Space Construction System (February 1995)
NFC	NFPA Codes, Handbooks, Standards, etc.
PL 100-678	Public Buildings Amendment Act
IBC	International Building Code
UL 790	Test Methods for Fire Resistance of Roof Covering Materials

UL Fire Protection Equipment Directory

UL Fire Resistance Directory

UL Building Materials Directory

Additional References

Society of Fire Protection Engineers Fire Protection Engineering Handbook

APPENDIX C

Applicable Design and Construction Criteria: The following VA documents relating to fire protection should have been furnished. It is important to verify they are the latest dates (most recent editions) with document owners.

Master Specifications (PG-18-1):

TITLE	SECTION	OWNER
Firestopping	07 84 00	003C2A
Sprayed-On Fireproofing	07 81 00	003C2A
Fire Protection	21 13 13	10NA8
Fire Alarm, Local Building System	28 31 00	10NA8

Design and Construction Procedures (PG-18-03):

TITLE	Topic	OWNER
Codes and Standards	01	003C2A
Drawings	02	003C2A
VA Hospital Building System	03	003C2A
Computer Systems	10	003C2A

Standard Details (PG-18-04):

TITLE	DETAIL	OWNER
Architectural		
Door Schedule	08100-1.DWG	003C2A
Door Schedule, Legend Notes and Modifications	08100-2.DWG	003C2A
Stair Details (Exit Stairs)	05510-1.DWG	003C2A
Mechanical Engineering HVAC		
Pipe/Duct Penetration of Fire/Smoke Barriers	07270-1.DWG	003C2A
Control of Smoke Damper at Smoke Partition:		
w/Duct Mounted Smoke Detector	15902- 34.DWG	003C2A
Section through Typical Fire Damper	15840-17.DWG	003C2A
Installation		
Fire Protection for Ceiling Outlets	15250-1.DWG	003C2A
Smoke & Combination Damper Fire/Smoke Damper Schedule	15902-2 DWG	003C2A
Hoistway Vent	15902-31 DWG	

Access Panels	15840-12 DWG	003C2A
Electrical Engineering		
Fire Alarm Symbols	16000-9 DWG	

Other VA Criteria

TITLE		OWNER
Qualifications and Scope of Services for Fire Protection Engineers		10NA8
Minimum Requirements for A/E Submissions (PG-18-15):		003C2A
Volume B	Major Renovation; Projects; Major Additions; and Other New Facilities	
Volume C	Minor New Building; Addition and Minor Renovation Projects	
Volume D	National Cemetery Projects	
Volume E	Design-Build Projects	
Volume F	Seismic Upgrade Projects	
A/E Review Checklists		
Architecture		
Boiler Safety Devices		
Electrical		
HVAC		
Incineration		
Plumbing/Fire Protection/Sanitary		
Site and Landscaping		
Steam Distribution		
Steam Generation		
Structural		
H-18-08	Seismic Design Requirements	003C2A
	VA Directive 2000-12 (March 23, 2000)	
PG-18-13	Barrier Free Design Guide	003C2A
	Uniform Federal Accessibility Standards	
	ADAAG	
PG-18-14	Room Finishes, Door, and Hardware Schedules	003C2A
VA Signage Manual (Environmental Graphics Design)		
Design Alerts		
Quality Alerts		
Technical Summaries		

Historic Preservation

Metrification

Additional References

FMERC Data Sheets

APPENDIX D

VA Design Manuals (PG-18-10):

TITLE	OWNER
Site Development	003C2A
Architectural	003C2A
Interior Design	003C2A
Specifications	003C2A
Equipment	003C2A
Automatic Transport	003C2A
Structural	003C2A
Sanitary	003C2A
Plumbing	003C2A
Steam Generation/	003C2A
Outside Steam Distribution	
Solid Waste Process Systems	003C2A
HVAC	003C2A
Asbestos Abatement	003C2A
Electrical	003C2A
Fire Protection	10NA8
Cost Estimating	003C2A
CPM Handbook	

VA Design Guides:

TITLE	OWNER
A&MMS (SPD)	003C2A
Clinical Series (Amb Care Invasive Procedures, Amb Care Hospital Based, Eye Clinics, Pharmacy, Pulmonary, SCI)	003C2A
Imaging Series (MRI, Nuclear Medicine, Radiation Therapy, Radiology)	003C2A
Primer Series (TB, Outpatient Pharmacy)	003C2A
Primary Care Series (CBOC, Satellite CBOCs)	003C2A
Research Series (Veterinary Medicine Units, Labs)	003C2A
Surgical Series (Ambulatory Surgery, Surgical Service)	003C2A

------END------

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Decision Tool to Determine Occupancy Classifications for Mixed Occupancies

This is a decision tool to determine whether a building or portion thereof is a healthcare occupancy, an ambulatory healthcare occupancy, or an occupancy other than healthcare and ambulatory healthcare. These questions are based on NFPA 101 (2009 Edition): Sections x.1.1.1; x.1.2; and x.1.3 of Chapters 18/19/20/21; and guidance provided in the Health Care Occupancy Classifier, by James K. Lathrop and David M. Birk, P.E., published in the Healthcare Fire Protection Newsletter, January, 1997. This version of the tool was updated by David P. Klein, P.E., and Peter A. Larrimer, P.E., April, 2010.

Question 1

In this portion of the building, are healthcare services and sleeping accommodations provided for four or more occupants who are mostly incapable of self-preservation because of age, physical or mental disability, or because of security measures not under the occupants' control?

If YES: Consider this portion of the building to be a healthcare occupancy.

If NO: Go to Question 2.

Question 2

On a routine basis, are there four or more patients (inpatients, outpatients or a mixture of both) in this portion of the building at the same time who are incapable of taking action for self-preservation under emergency conditions without assistance from others? (Include all incapable inpatients. Include outpatients who are rendered incapable due to the treatment or anesthesia they received in this portion of the building. If emergency or urgent care is provided, include patients who are incapable due to the nature of their injury or illness. Also, note that being confined to a wheelchair does not in itself make a person incapable of taking action for self-preservation.)

If YES: Go to Question 3.

If NO: Go to Question 7.

Question 3

Is this portion of the building contiguous to a healthcare occupancy?

If YES: Go to Question 4.

If NO: Consider this portion of the building to be an ambulatory healthcare occupancy.

Question 4

Is this portion of the building intended primarily for outpatient or non-patient use?

If YES: Go to Question 5.

If NO: Evaluate this portion of the building as a healthcare occupancy, since it is not primarily intended for outpatient or non-patient use.

Question 5

Is this portion of the building separated from the healthcare portions of the building by at least two-hour fire-resistance rated construction?

If YES: Go to Question 6.

If NO: Evaluate this portion of the building as a healthcare occupancy, since it is not properly separated from the healthcare occupancy.

Question 6

On a routine basis, are there four or more inpatients in this portion of the building at the same time who are incapable of taking action for self-preservation under emergency conditions without assistance from others?

If YES: Evaluate this portion of the building as a healthcare occupancy.

If NO: This portion of the building may be evaluated as an ambulatory healthcare occupancy.

Question 7

Is this portion of the building contiguous to a healthcare occupancy ?

If YES: Go to Question 8.

If NO: Go to Question 9.

Question 8

Is this portion of the building separated from the healthcare portions of the building by at least two-hour fire-resistance rated construction?

If YES: Go to Question 9.

If NO: Evaluate this portion of the building as a healthcare occupancy, since it is not properly separated from the healthcare occupancy.

Question 9

Is this portion of the building contiguous to an ambulatory healthcare occupancy?

If YES: Go to Question 10.

If NO: This portion of the building may be evaluated as an occupancy other than healthcare or ambulatory healthcare.

Question 10

Is this portion of the building separated from the ambulatory healthcare portions of the building by at least 1-hour fire resistance rated construction?

If YES: This portion of the building may be evaluated as an occupancy other than healthcare or ambulatory healthcare.

If NO: Evaluate this portion of the building as an ambulatory healthcare occupancy, since it is not properly separated from the ambulatory healthcare occupancy.

Caution Areas

Chemical Compatability (Page 1 of 2)

Harvel® CPVC industrial, plumbing, and fire sprinkler piping systems have been used successfully for more than 45 years in new and retrofit construction. Harvel CPVC products are ideally suited for these applications due to their outstanding corrosion resistance. CPVC Fire Sprinkler Products resist attack from a wide range of chemicals that are corrosive to metallic piping. This important property has resulted in CPVC being the material of choice for use in corrosive-piping applications for many years due to its inherent corrosion resistance and exceptional chemical resistance to a wide range of chemicals. Properly designed, installed and cared for, Harvel CPVC piping systems will perform without issue and will bring the property owner years of safety and security.

As with any piping material, there are however, certain chemicals that can be detrimental to CPVC. Occasionally some of these chemicals may be found in certain construction products and specific site preparations. **CPVC materials can be damaged by contact with chemicals found in some construction and ancillary products such as thread sealants, anti-freeze solutions, fire stop materials, etc. It is important to verify the compatibility of materials that come in contact with the CPVC system to ensure long-term performance.**

ALWAYS CHECK with Harvel (the pipe manufacturer), and the manufacturer of the CPVC fittings and solvent cement if you have questions regarding chemical compatibility. Harvel currently publishes a chemical resistance guide for our piping products, which can be found on-line at http://www.harvel.com/tech-support-chem.asp.

Certain CPVC material manufacturers also provide detailed chemical resistance data on their CPVC compounds, and also provide an on-going chemical compatibility program where a list of acceptable and unacceptable products is maintained. If chemical compatibility with CPVC remains in question, it is recommended to isolate the suspect product from direct contact with CPVC pipe or fittings.

Harvel® manufactures CPVC Fire Sprinkler Piping Products from BlazeMaster® CPVC compounds (i.e. Harvel BlazeMaster). BlazeMaster® is a trade name of the raw material (CPVC compound) that is used by Harvel to manufacture the pipe.

- Chemical compatibility information pertaining to CPVC pipe and fittings manufactured from BlazeMaster® CPVC compounds can be found on-line at http://www.blazemaster.com/chemical-compatibility/products-Americas.asp Users of BlazeMaster CPVC products should visit this website and review the BlazeMaster System Compatibility information. The BlazeMaster System Compatibility Program tests and monitors ancillary products on an ongoing basis to ensure chemical compatibility with BlazeMaster CPVC products and those products that are compatible carry a compatibility mark to assist the user in identifying acceptable ancillary products.

CPVC Compatability Concerns:

Thread Sealants: Some thread paste sealants contain solvents, oils or other chemical additives that can cause damage to CPVC. Only compatible thread sealants and tapes should be used with CPVC. Refer to Harvel's Installation Instructions for additional information on threaded connections.

Fire Stops Materials: Some fire stop sealants contain solvents, plasticizers or other chemical additives that can cause damage to CPVC. Only compatible fire stop materials should be used with CPVC.

Anti-Freeze Solutions: DO NOT USE GLYCOL BASE ANTI-FREEZE SOLUTIONS. The use of improper anti-freeze solutions such as ethylene glycol, propylene glycol and/or contaminated glycerin solutions can cause stress cracking of CPVC resulting piping system failure. Anti-Freeze solutions of U.S.P. or C.P. grade GLYCERIN are acceptable for use with CPVC fire sprinkler products. Refer to appropriate NFPA Standards concerning Anti-Freeze Systems and Harvel's Installation Instructions for additional information.

Soldering/Hot Work: Soldering of metallic components in close proximity to CPVC piping will cause damage to CPVC piping systems. Direct contact with heat (open flame), solder, and soldering flux is not recommended. These types of products should be isolated from direct contact with CPVC piping products. CPVC contact with solder flux can cause cracks, leaks and breaks in the piping system. Any CPVC pipe or fittings that have solder flux on them (as identified by staining or discoloration of the pipe and fittings) should be removed and replaced with new CPVC materials.

Flexible Wire: Direct contact with flexible wire and cable should be avoided as the insulation for the wire and cable can contain plasticizers that can cause CPVC piping systems to crack, leak or break. The finished installation should be inspected to verify that the fire sprinkler system is not being used to support wire or cable, and that runs of wire and cable have not been pulled over the installed CPVC system. Additionally, the CPVC piping systems should not be supported with electrical cable or flexible wiring, and all hanger support recommendations should be followed. Section 334.30 of the National Electric Code (2002 Edition) requires wire and cable to be secured by staples, cable ties, straps, or hangers. Air ducts, pipes and ceiling grid are not acceptable supports for wire and cable.

Caution Areas

Chemical Compatability (Page 2 of 2)

Steel Pipe Transitions: Transitions from steel pipe to CPVC pipe can be made through a variety of methods such as threaded, flanged, and grooved transition components. Occasionally the steel pipe may contain residual oils that were used to aid in the metal cutting process. Some of the oils used for this purpose may be incompatible with CPVC. These cutting oils should be removed from the steel pipe prior to connecting to CPVC pipe by fully cleaning the inside and outside of the pipe before it is assembled in the fire sprinkler system. Care should be taken when selecting cleaning agents to avoid further contamination of the pipe with such elements as surfactants. If cutting oil is used consult with the manufacturer of the cutting oil for a specific recommendation as to compatibility with CPVC. Cutting oils that are listed in the BlazeMaster® compatibility program have been tested and confirmed to be acceptable for use with CPVC.

Paint: Oil or solvent-based paints may be chemically incompatible with CPVC. Water-based acrylic or latex paint is the preferred paint to use on CPVC pipe and fittings. Approval from the Authority Having Jurisdiction must be obtained prior to covering/painting the markings on the product (i.e. product identification, listing marks, etc.) and to change color of the pipe and fittings from its identifiable orange.

Cooking Oils and Grease: When CPVC pipe is installed in kitchen areas the pipe must be protected from contact with grease or cooking oils. Certain cooking oils can cause the CPVC piping to crack, leak or break when applied to the piping system. Consideration must be given to not only protecting the pipe from direct contact with cooking oils and/or grease, but also contact that may occur from airborne grease or oil from the environment such as cooking. Exposed piping in areas where CPVC pipe might come in contact with cooking oils and grease should be protected using a soffit system or with a complete coating of high quality water based paint that fully protects the piping system.

Rubber and Flexible Materials: CPVC is typically not compatible with rubber and flexible plastic materials as these materials often contain certain types of plasticizers which when placed in contact with CPVC can cause the piping system to crack, leak or break. (Incompatible plasticizers include, but are not limited to, phthalates, adipates, trimellitates, dibenzoates, etc.) Incompatible rubber and flexible plastic materials can be found in hoses and tank linings and in the fluids that come in contact with them.

Spray On Coatings: Certain types of spray-on coatings that form a peelable film to protect fixtures during construction may be incompatible with CPVC. Care should be used to protect exposed piping from over-spray when this type of protective coating is applied.

Termiticides and Insecticides: When performing installations under-slab or where the presence of insecticides or termiticides is likely, care should be taken to isolate CPVC pipe from direct contact with large quantities (what is the quantity) of these chemicals. CPVC can be damaged when termiticides or insecticides are injected into the annular space between the pipe wall and sleeving material trapping the termiticide against the pipe wall. Termiticide applications per label instructions in an open-air environment, such as slab pretreat applications, should not pose a problem. However, puddling of termiticides on or near CPVC pipe may cause failures. In areas where puddling is more likely, such as areas near tub boxes and retreat applications, extra care should be taken to avoid puddling of termiticides Before using an insecticide or termiticide, be sure to consult the manufacturer's installation guide for proper application instructions. For a listing of insecticides or termiticides that are included in the BlazeMaster System Compatible Program, refer to the BlazeMaster website at http://www.blazemaster.com/chemical-compatibility/products-Americas.asp. Additional precautions need to be taken when retreat applications are required. Termiticide retreatment is usually required when the concrete slab has been broken to relocate a pipe. The following recommendations should followed in retreat applications:

- Remove all the plastic barrier material that was installed prior to the initial concrete pour from the area to be retreated. Do not reinstall the plastic barrier material.
- After the pipe has been relocated, the soil should be pretreated before it is placed in the hole around the pipe. Do not apply termiticide directly to the retreat area.

In situations where sleeving is required, the pipe should be protected with a compatible sleeving material extending at least 12" above and below the soil. The top of the sleeving should be securely taped to the pipe with a compatible tape product. Backfill over underground piping prior to termiticide spraying.

Mold Abatement and Fungicides: Building restoration projects used to repair water damage often include the use of mold abating products such as fungicides. These products can damage CPVC piping systems and can cause cracks, leaks, or breaks in the system. When performing repairs or modifications care should be taken to isolate the CPVC piping system from direct contact with fungicide products. When repairs are made to an existing system, and the possibility exists that fungicides will be applied to treat damp drywall and wood framing surrounding the repair site, exposed piping should be sleeved with a compatible plastic sleeving or pipe insulation material to prevent direct contact of the fungicide with the CPVC piping system.

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Potential Damage to CPVC Fire Sprinkler Systems From Spray Foam Insulation

Spray Foam Insulation Systems typically used in attics to insulate from heat loss have in some cases caused damage to CPVC Fire Sprinkler Systems from either Environmental Stress Cracking (ESC) or adverse Heat Distortion.

Environmental Stress Cracking

In plastics, this is a crazing, cracking, or fracturing in the presence of an incompatible environment and some form of stress. Most often it is a chemical environment, thus "chemically induced Environmental Stress Cracking or simply, “ESC”. This is sometimes hard to detect until a major problem develops. The foam insulation system manufacturer must be consulted to insure full compatibility of their product with CPVC piping systems.

Heat Distortion

Heat is generated by the reaction of spray foam insulation with air during application. The temperatures developed can soften the material and easily result in adverse expansion or even ballooning in CPVC piping systems if improperly applied. The foam insulation system manufacturer must be consulted to insure the proper method of application is used to prevent heat distortion in CPVC piping systems.

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Potential Damage to CPVC Fire Sprinkler Systems From Connection to Anti-Bacterial Corrosion Lined Metal Piping

CPVC piping has been successfully used in combination with copper or steel piping for many years when proper attention is given to packing or cutting oils and thread sealants used to insure that Environmental Stress Cracking (ESC) is not a problem. However, new Anti-Bacterial Corrosion coatings designed to prevent Microbiological Influenced Corrosion (MIC) that are applied as a lining to metal pipe are at the center of a major ESC problem concerning combination of CPVC with Metal fire sprinkler systems.

While industry testing being conducted to determine cause has yet to be completed, reported data developed to date strongly suggests that the chemicals responsible for the fracturing of both CPVC pipe and fittings on at least one project are a part of the Anti-Bacterial Corrosion coating that lined the inside of the metal pipe. We believe this is sufficient reason to issue warning.

The installing contractor must identify any chemical agents (Such as but not limited to thread cutting oils, thread pastes, packing oils, insulating foams, or anti-bacterial corrosion coatings) that may come into contact with the CPVC system and verify through the proper substance manufacturer that those chemicals will not harm CPVC plastic material in any way.

NOTICE

This building contains a CPVC fire sprinkler system. This CPVC fire sprinkler system is a Life Safety Assembly and must be treated carefully. Please read the following before any activity which could contact this system:

CPVC piping components may be damaged by certain substances and construction practices.

- DO NOT stack, support, hang equipment, or hang flexible wire/cable, especially communications cable, or other material on the fire sprinkler system.
- ONLY system compatible materials including, but not limited to solvent cements, caulks, sealants, cutting oils and thread pastes as noted by the CPVC fire sprinkler piping system manufacturer's installation instructions should be used in contact with this system.
- DO NOT expose CPVC products to incompatible substances, such as cutting oils, non-water based paints, packing oils, traditional pipe thread paste and dope, fungicides, termiticides, insecticides, detergents, building caulks, adhesive tape, solder flux, flexible wire/cable (with special consideration for communications cabling), and non-approved spray foam insulation materials.
- DO NOT expose CPVC products to edible oils, solvents, or glycol-based anti-freeze fluids.
- DO NOT expose CPVC products to open flame, solder, and soldering flux.
- DO NOT drop, distort, or impact CPVC products or allow objects to be dropped on them.
- DO NOT handle CPVC products with gloves contaminated with oils (hydrocarbons) or other incompatible materials.

Failure to follow this notice may cause cracks or fractures to develop in CPVC products resulting in property damage due to leaks or flooding. The presence of any visible cracks may require partial or full system replacement. For additional information contact the general contractor or the fire sprinkler system installer.

SPEARS FlameGuard™ CPVC FIRE SPRINKLER PRODUCTS

FOR ADDITIONAL INFORMATION CONTACT
SPEARS® MANUFACTURING COMPANY AT 1-800-862-1499

Rev 3.0 Jan 2008

Important Information with Regards to Your CPVC Fire Sprinkler System

CONGRATULATIONS, your building structure contains a state of the art life safety system. Your CPVC fire sprinkler system will enhance the safety and security of your building when properly cared for. CPVC Fire Sprinkler Products resist attack from a wide range of chemicals that are corrosive to metallic piping. As with any piping material, there are however, certain chemicals that can be detrimental to CPVC. Occasionally some of these chemicals may be found in some construction products, site preparations and building maintenance. There are certain things that you need to be mindful of in caring for or working around your CPVC fire sprinkler system.

Keep your system clear from contact with the following products and chemicals unless product labels state materials are compatible with CPVC:

NOTICE

	Property maintenance services
Cleaning Products Detergents Oils/Lubricants/Greases Rubbery Materials	Fungicides Mold Remediation Chemicals Termiticides / Insecticides
For hired contractors & do-it-yourselfers	
Corrosion Inhibitors Glycol-based antifreezes Solder Flux Thread Sealants Flexible Cable / Wiring (especially communications cabling) Caulks/Mastics Adhesive Vinyl / Electrical Tape Non-Approved Spray Foam Insulation Non-Water Based Paint Paint Thinners Wood Finishes/Varnishes	

You should also avoid the following:

- Sitting, standing, hanging, leaning, or resting anything on the pipe, fittings, and sprinkler heads
- Grounding electrical wiring to the pipe or fittings
- Ambient temperatures below 40°F/4°C where your fire sprinkler system is located. (Unless an approved compatible antifreeze or insulation method is installed.)
- Hot work around the pipe, i.e. blow torches, soldering, etc.

Be certain that this document is reviewed and understood by anyone working on or around your CPVC life safety system. If you have any questions or need assistance on chemical compatibility with your CPVC fire sprinkler system, contact the manufacturer listed on the pipe.

Proper care will help your CPVC fire sprinkler system provide protection for years to come.

FOR ADDITIONAL INFORMATION CONTACT SPEARS® MANUFACTURING COMPANY AT 1-800-862-1499

The landmark Americans with Disabilities Act (ADA), enacted on July 26, 1990, provides comprehensive civil rights protections to individuals with disabilities in the areas of employment (title I), State and local government services (title II), public accommodations and commercial facilities (title III), and telecommunications (title IV). Both the Department of Justice and the Department of Transportation, in adopting standards for new construction and alterations of places of public accommodation and commercial facilities covered by title III and public transportation facilities covered by title II of the ADA, have issued implementing rules that incorporate the Americans with Disabilities Act Accessibility Guidelines (ADAAG), developed by the Access Board.

U N I T E D   S T A T E S   A C C E S S   B O A R D
A FEDERAL AGENCY COMMITTED TO ACCESSIBLE DESIGN



BULLETIN #2: VISUAL ALARMS

Why are visual alarms required?

One American in a hundred has a severe hearing loss; nearly one in ten has a significant loss. In 1984, the Digest of Data on Persons with Disabilities reported that: "(t)he severity of hearing problems was strongly associated with age. persons 65 and older constituted 69 percent of the population with the most severe hearing trouble...but only 8.7 percent of the population without hearing trouble." Those who are deaf or hard-of-hearing--a growing percentage of our population, due largely to the growth in the numbers of older persons--depend upon visual cues to alert them to emergencies. A visual alarm provides persons with hearing loss the same warning delivered to hearing persons by an audible alarm.

4.1.3 (14) New Construction. *If emergency warning systems are provided, then they shall include both audible and visual alarms complying with 4.28. Emergency warning systems in medical care facilities may be modified to suit standard health care alarm design practice.*

Audible fire alarms have been a standard feature of building construction since the life safety codes of the early 1900s. However, visible signals did not appear even in accessibility codes until 1980. Early standards required relatively dim flashing lights at exit signs--an alarm system that was effective only along an exit route. As accessibility, life safety, and building codes were revised, however, they began to incorporate alarm technology that was developed for use in schools for persons who are deaf and in factories where ambient noise levels made audible alarms ineffective.

4.28 Alarms.
4.28.1 General. *Alarm systems required to be accessible by 4.1 shall comply with 4.28. At a minimum, visual signal appliances shall be provided in buildings and facilities in each of the following areas: restrooms and any other general usage areas (e.g., meeting rooms), hallways, lobbies, and any other area for common use.*

In passing the Americans with Disabilities Act in 1990, Congress specifically directed the Access Board to provide greater guidance regarding communications accessibility. Thus the ADA Accessibility Guidelines (*ADAAG*) require that where emergency warning systems are provided in new or altered construction, they must include both audible and visible alarms that meet certain technical specifications.

What are visual alarms?

Visual alarms are flashing lights used as fire alarm signals. The terms visual alarm signal, visible signal device, and visible signaling appliance are used relatively interchangeably within the fire protection community; the National Fire Protection Association (NFPA) calls them visual notification appliances. There is no practical distinction between a visual signal and a visible signal. Although visual signals may be used for other purposes, the type described in this Bulletin is appropriate only for use as an emergency alarm signal. An illustration shows a type of commercially-available alarm fixture that incorporates a visual alarm.

3.5 Definitions. Common Use. *Refers to those interior and exterior rooms, spaces, or elements that are made available for the use of a restricted group of people (for example, occupants of a homeless shelter, the occupants of an office building, or the guests of such occupants).*

There are two major categories of fire alarms:

- *self-contained units*, as exemplified by the single-station residential smoke detector unit--battery-operated or hard-wired to building electrical power--which produces an alarm signal at the fixture itself when activated by an integral sensing device, and
- *building-wide systems*, integrated--often zoned--alarms whose local signals are remotely initiated, either automatically from detectors or manually from pull-stations spread throughout a facility.

ADAAG requires that when either type is installed, it must have a visual alarm component.

4.1.1 Application. (3)* Areas Used Only by Employees as Work Areas. *Areas that are used only as work areas shall be designed and constructed so that individuals with disabilities can approach, enter, and exit the areas. These guidelines do not require that any areas used only as work areas be constructed to permit maneuvering within the work area or be constructed or equipped (i.e., with racks or shelves) to be accessible.*

For information on employee accommodation under title I of the ADA, contact the Equal Employment Opportunity Commission (EEOC) ADA information line at (800) 669-4000 (voice) (800) 800-3302 (TTY)

4.28.3 Visual Alarms. *Visual alarm signal appliances shall be integrated into the building or facility alarm system. If single station audible alarms are provided then single station visual alarm signals shall also be provided. Visual alarm signals shall have the following minimum photometric and location features:*
(1) The lamp shall be a xenon strobe type or equivalent.
(2) The color shall be clear or nominal white (i.e., unfiltered or clear filtered white light).

Where are visual alarms required?

Facility design is subject to state and local ordinances that may both require and specify standards for emergency alarm systems. These regulations--building codes, life safety codes, accessibility codes, technical standards--are typically based upon national model codes and standards. The *requirement* for an emergency alarm system in new construction will be established by the applicable State or local building, life safety, or fire protection regulation. *ADAAG* does not mandate an emergency alarm system; its scoping provision at 4.1.3(14) simply requires that *when* emergency warning systems are provided, they shall include both audible and visual alarms that comply with 4.28.

Thus the requirement for an alarm system in a facility will trigger the *ADAAG* technical specifications for alarms. *ADAAG* 4.1.3(14) Accessible Buildings: New Construction requires that visual alarms be installed if emergency warning systems are provided in a new facility. In existing buildings, the upgrading or replacement of a fire alarm system also requires compliance—see *ADAAG* 4.1.6(b)—with *ADAAG* technical provisions for alarms.

Because it is not always possible to fix the occupancy of a room or space or anticipate its use by a person with a hearing impairment, visual alarms are required in every common use room or space in facilities equipped with an emergency alarm system. This is particularly important in those common use spaces where a person may be alone. *ADAAG* 4.28.1 General stipulates that alarm systems required to be accessible shall provide visible signals in restrooms, in other general and common use areas, and in hallways and lobbies. Common use areas also include meeting and conference rooms, classrooms, cafeterias, filing and photocopy rooms, employee break rooms, dressing, examination, and treatment rooms, and similar spaces that are not used solely as employee work areas.

System designers and specifiers must be particularly attentive to signal coverage issues. Where audible alarms are installed in corridors and lobbies to serve adjacent common use rooms, individual visual alarm signal appliances must be installed in those rooms, since the warning provided by a visual signal, unlike that of a bell or other annunciation system, can only be observed within the space in which it is installed. Dressing and fitting rooms, for example, can be easily protected by an audible alarm outside the room or space. However, the customer or patient who has a hearing impairment will not be alerted unless the dressing room he/she is using is protected with a visual alarm in (or above, if partitions do not extend to full height) the space. In general, it is not sufficient to install visual signals only at audible alarm locations.

Where are visual alarms *not* required?

ADAAG does not require that areas used only by employees as work areas be fully accessible. Thus, visual alarms are not required in individual employee offices and work stations. However, providing a visual alarm in the work area of an employee who is deaf or hard-of- hearing may be--like other elements of

(3)
The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time between initial and final points of 10 percent of maximum signal.
(4)
The intensity shall be a minimum of 75 candela.
(5)
The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
(6)
The appliance shall be placed 80 in (2030 mm) above the highest floor level within the space or 6 in (152 mm) below the ceiling, whichever is lower.
(7)
In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft (30 m) across, without obstructions 6 ft (2 m) above the floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft (30 m) apart, in lieu of suspending appliances from the ceiling.
(8)
No place in common corridors or hallways in which visual alarm signalling appliances are required shall be more than 50 ft (15 m) from the signal.

workplace accessibility-- a reasonable accommodation under title I of the ADA, which addresses employment issues. The potential for such future employee accommodations should be considered when facility wiring is planned to facilitate a later connection to the building alarm system. Mechanical, electrical and telephone closets, janitor's closets, and similar non-occupiable spaces that are not common use areas nor assigned work areas are not required to have visual alarms. For information on employee accommodation under title I of the ADA, contact the Equal Employment Opportunity Commission (EEOC) ADA information line at (800) 669-4000 (voice) or (800) 800-3302 (TTY).

What technical provisions apply to visual alarms?

The technical provisions of *ADAAG* 4.28 Alarms include minimum standards for the design and installation of single-station and building-wide visual alarm systems. They are based upon research sponsored by the Access Board and other groups, principally Underwriters Laboratories (UL).

To be effective, a visual signal--or its reflection from adjacent walls and ceiling--must be of an intensity that will raise the overall light level sharply, but not so intense as to be unsafe for direct viewing at a specified mounting height. Technical criteria for visual alarm signal appliances are established in *ADAAG* 4.28.3 Visual Alarms (see sidebars).

In research sponsored by the Access Board, a high-intensity xenon strobe lamp was found to be the most effective in alerting persons with hearing impairments. White light was judged to be the most discernible; colored lamps (particularly red) were not effective even at extreme intensities.

Ninety percent of the research subjects were alerted by a 75 candela (cd) signal mounted fifty feet away on the wall directly behind them, where the horizontal output of a strobe lamp is measured at 100% of its nominal rating. For this reason, 75 cd is a minimum performance criterion--not a lamp sizing or specifying standard--for all locations within the 50-foot radius of the covered area. Because most strobes are not point sources, light output falls off sharply to the sides; a lamp with a maximum output of 75 cd when measured at 0 degrees will not provide the required increase in illumination at a 45 degree angle. Lamp intensity is given in effective candela, measured in use at the source.

Like a camera flash, the strobe produces a short burst of high-intensity light. The repetition of this pulse at a regular interval is the flash rate. Pulse duration--the interval of the flash between signal build-up and decay--is limited so that the signal is not temporarily blinding. Testing indicated that flash rate cycles between one and three Hertz (flashes per second) successfully alerted subjects with hearing impairments; a 3 Hz rate appeared to be somewhat more effective. Lamps tested at 1/3 Hz were adjudged ineffective. *ADAAG* thus requires flash rates within the 1 to 3 Hz range.

Rates that exceed 5 flashes per second may be disturbing to persons with photosensitivity, particularly those with certain forms of epilepsy. Information received during the development of these guidelines suggests that multiple unsynchronized visual signals within a single space may produce a composite flash rate that could trigger a photoconvulsive response in such persons (for example, two strobes set at 3 Hz in a room could generate a combined flash rate of 6 Hz). Installations that may produce a composite rate in excess of 5 Hz should therefore be avoided by decreasing the number of fixtures and raising the intensity of the lamps they contain, by decreasing the flash rate of multiple lamps, or by synchronizing the flash rates of multiple fixtures. This is particularly important in schools, since children are more frequently affected by photosensitivity than are adults.

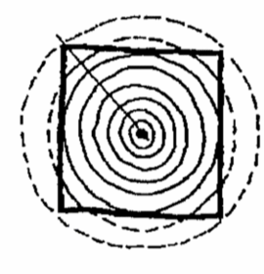
Mounting provisions were developed from NFPA signal criteria and UL smoke test findings. Strobes--whether projected from a wall or suspended from the

ceiling--must be a minimum of 6 inches below the ceiling plane to avoid smoke obscuration in the event of a fire. To comply with provisions covering protruding objects, alarm devices must be at least 80 inches above the finished floor. To preclude installations that might be outside the field of view in high-ceilinged spaces such as atriums and warehouses, the guidelines require a strobe to be mounted at the lower of the two heights. However, photometric calculations of lamp intensity for mounting heights of 80 inches and of 96 inches show only nominal differences and can be practically considered to be equivalent. A single visual signal meeting *ADAAG* specifications could be expected to serve a large room or length of corridor if optimally located on perimeter walls or suspended below the ceiling so that the signal can spread throughout the space, unobstructed by furnishings, equipment, or room geometry.

In multipurpose facilities where bleacher seating, athletic equipment, backdrops, and other movable elements may at times be deployed or in warehouses, libraries, convention centers and other building types where devices would not be visible when installed at specified heights, optimal signal placement may require considerable study and the development of alternative intensity and placement calculations as an equivalent facilitation.

Provisions governing the spacing of visual alarms in hallways and corridors will generally require one fixture every 100 feet. In lengthy corridors, such as in shopping malls and large buildings, it is recommended that appliance spacing be maximized within the limits of the technical provision to minimize the effect of a composite flash rate on persons with photosensitivity. It is further recommended that the placement of visual signals along a corridor alternate between opposing walls to minimize the number of signals in a field of view.

Strobe Lamp Coverage
Recommended



Not Recommended



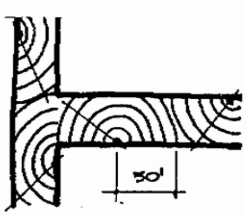
2.2 Equivalent Facilitation. *Departures from particular technical and scoping requirements of this guideline by the use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility.*

What criteria affect the design of visual alarm systems?

Illustrations 2 through 4 describe general fixture placement and lamp coverage in schematic form:

In general, it is recommended that visual alarm lamp intensity be maximized so as to require the minimum number of fixtures. Large, high-ceilinged spaces may best be served by suspended flash tubes of very high intensity (lamps up to 1000 candela are available for such applications). Smaller rooms, with an area that can be circumscribed by a circle 50 feet in radius, can be covered by a single, centrally located visual alarm meeting *ADAAG* intensity specifications. For very small rooms, such as examination, toilet, and dressing rooms, a single strobe of lesser intensity may well be sufficient as an equivalent facilitation.

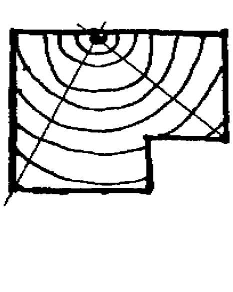
Recommended Spacing in Corridors



When should equivalent facilitation be considered?

ADAAG technical provisions apply to normative conditions. Signal intensity and placement in very small and very large rooms and in spaces with high ceilings, irregular geometry, dark or non-reflective walls, or very high ambient lighting levels may best be determined by specialized consultants employing photometric calculation for system design rather than by a literal application of *ADAAG* specifications. For these reasons, *ADAAG* 2.2 Equivalent Facilitation permits alternative designs that achieve substantially equivalent or greater accessibility.

Recommended Placement in Irregularly Configured Room



Lamp intensity (like sound) decreases in inverse relation to the square of its distance from the viewer. Thus, by varying lamp intensity and spacing, system designers can tailor an installation to the physical conditions of the space being served. It is impossible to provide specific guidance for the design of non-standard installations based upon the photometric calculations necessary to demonstrate equivalent facilitation. Such applications should generally be designed by experienced electrical engineers or fire alarm consultants under performance specifications for coverage and illumination levels derived from the technical provisions of *ADAAG* 4.28 and ambient conditions in the space. For example, a 75 cd strobe at 50 feet raises the ambient light by 0.03 at 0 degrees

in the horizontal plane. Equivalent design configurations should, therefore, result in approximately the same increase at all positions within the covered space.

4.28.4 Auxiliary Alarms. *Units and sleeping accommodations shall have a visual alarm connected to the building emergency alarm system or shall have a standard 110-volt electrical receptacle into which such an alarm can be connected and a means by which a signal from the building emergency alarm system can trigger such an auxiliary alarm. When visual alarms are in place the signal shall be visible in all areas of the unit or room. Instructions for use of the auxiliary alarm or receptacle shall be provided.*

9.3 Visual Alarms, Notification Devices and Telephones.
9.3.1 General. *In sleeping rooms required to comply with this section, auxiliary visual alarms shall be provided and shall comply with 4.28.4. Visual notification devices shall also be provided in units, sleeping rooms and suites to alert room occupants of incoming telephone calls and a door knock or bell. Notification devices shall not be connected to auxiliary visual alarm signal appliances [...].*

9.3.2 Equivalent Facilitation. *For purposes of this section, equivalent facilitation shall include the installation of electrical outlets (including outlets connected to a facility's central alarm system) and telephone wiring in sleeping rooms and suites to enable persons with hearing impairments to utilize portable visual alarms and communication devices provided by the operator of the facility.*

As there is no process for certifying alternative methods (except in transportation facilities under DOT enforcement), the responsibility for demonstrating equivalent facilitation in the event of a challenge rests with the covered entity.

The American National Standard for Accessible and Usable Buildings and Facilities (CABO/ANSI A117.1-1992), reflecting current NFPA 72 performance recommendations for visual alarms, stipulates lamp, installation, and spacing criteria at some variance with *ADAAG* technical specifications for visual alarms and with this Bulletin. ANSI Table 4.26.3.2(a), Room Spacing Allocation, suggests that an alarm installation of several low-intensity lamps within a room is the practical equivalent of a single high-intensity lamp serving that space.

Given concerns for economy (lower-candela lamps are less expensive to purchase and connect) and lamp standardization within a building (lower-candela lamps are more available and simplify inventorying), specifiers may be motivated to standardize on a minimum-candela fixture, achieving coverage in large rooms by close spacing of low- intensity lamps. The Access Board strongly discourages this practice. Where a single lamp can provide the necessary intensity and coverage, multiple lamps should not be installed because of their potential effect on persons with photosensitivity.

What types of visual alarms are available?

Most major suppliers to the fire protection industry manufacture visual appliances, which are readily available to electrical contractors and others responsible for the installation of building alarm systems. Visual alarms incorporating smoke detectors and lamp-only signal appliances are supplied through standard sources, although some lamp intensities and visual alarm fixtures may not be commonly stocked. Strobe lamps are commercially available in varying intensities up to 200 candela. Higher intensities can be provided by specialized manufacture.

Although an integrated audible and visual signal is available at about the same cost as an audible or visual signal alone, more visual signals than audible signals will be necessary for most applications. Careful attention to reflection from surfaces can increase light dispersion and coverage in both new and renovated structures.

What visual alarm requirements apply to sleeping rooms in transient lodging facilities?

ADAAG 9.3.1 requires that sleeping units covered by Section 9 Accessible Transient Lodging have a visual alarm connected to the building alarm system or provide a power outlet for a portable device that can be triggered by the building emergency alarm system (such units can be activated by a signal from the central alarm control system, transmitted through the standard 110V building wiring to a receiver plugged into a power outlet at a remote location). Portable units with a standard 110 volt electrical cord are available from specialized retailers of products for persons who are deaf and hard-of- hearing. Because guest room sizes are not large in such occupancies, the technical specification of 4.28.4 Auxiliary Alarms requires only that the signal--intended to alert persons who are awake--be visible in all areas of the room or unit.

Visual alarms are not the technology of choice for awakening sleeping persons, however. A UL study concluded that a flashing light more than seven times brighter than that needed to alert office workers would be required to arouse a person who was asleep (110 cd vs. 15 cd at 20 feet, if mounted 24 inches or more from the ceiling; 177 cd if mounted less than 24 inches from the ceiling, where smoke obscuration might be a significant factor). Alarm system designers

are advised to consider the UL findings if visual alarms are to be employed to warn sleeping persons of emergencies.

ADAAG does not establish standards for portable items or auxiliary aids. However, devices that employ technologies other than visual signaling may offer equivalent or superior warning for sleeping guests who have hearing impairments. For example, a signal-activated vibrator was found to be much more effective in alerting sleepers than were the visual signals tested in the UL research. Such devices are commonly available and may be connected to or activated by a building alarm system. Care must be taken that notification devices intended to signal a door knock or bell are separately wired.

Why is there an exception in the scoping requirements of 4.1.3(14) for "standard health care alarm design practice"?

In medical care settings where a supervised emergency evacuation plan is in place, it is usually not desirable to install alarms in patient rooms or wards. In such occupancies, personnel responsible for ensuring the safe egress of patients will respond to an intercom message or other signal that is not intended to alert or alarm patients incapable of independent evacuation. Additionally, visual alarms may not be appropriate for use in some specialized medical facilities, such as operating rooms, where lighting levels are high and the sudden discharge of a strobe flash might adversely affect a surgical procedure. For such facilities, the requirements for visual and audible alarms may be modified to suit industry-accepted practices.

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